Animals

25.03.06р.

351. $\sin\left(\frac{\pi}{3}+3x\right)-\sin\left(\frac{2}{3}\pi-x\right)=\sin(\pi+x)$

$2\sin\left(2x-\frac{\pi}{6}\right)\cos\left(\frac{\pi}{2}+x\right)=-\sin x$

$2\sin\left(2x-\frac{\pi}{6}\right)(-\sin x)+\sin x=0$

$\sin x)\left(1-2\sin\left(2x-\frac{\pi}{6}\right)\right)=0$

$\left[\begin{array}{l}\sin x=0\\ 1-2\sin\left(2x-\frac{\pi}{6}\right)=0\end{array}\right.\Rightarrow\left[\begin{array}{l}x=\pi k\\ \sin\left(2x-\frac{\pi}{6}\right)=\frac{1}{2}.\end{array}\right.\Rightarrow$

$\Rightarrow\left[\begin{array}{l}x=\pi k\\ \left(2x-\frac{\pi}{6}=(-1)^k\frac{\pi}{6}\right)2x=\frac{\pi}{6}+(-1)^k\frac{\pi}{6}+\pi k\end{array}\right.$

$k\in Z$

$k=2n$

$k=$

$2x=\left[\begin{array}{l}\frac{\pi}{3}+2\pi n\\ \pi(2n+1.\end{array}\right.$

а) $\cos\left(4x+\frac{\pi}{6}\right)+\cos\left(2x+\frac{\pi}{6}\right)=\cos\left(\frac{\pi}{2}+2x\right)$

$2\cos\left(3x+\frac{\pi}{6}\right)\cos x=-\sin 2x$

$2\cos\left(3x+\frac{\pi}{6}\right)\cos x+2\sin x\cos x=0.$

$2\cos x\left(\cos\left(3x+\frac{\pi}{6}\right)+\sin x\right)=0$

$\left[\begin{array}{ll}\cos x=0 & x=\frac{\pi}{2}+\pi k\\ \cos\left(\frac{\pi}{6}+3x\right)+\sin x=0 & \Rightarrow\end{array}\right.$

$\Rightarrow \cos\left(\frac{\pi}{6}+3x\right)+\cos\left(\frac{\pi}{2}-x\right)=0.$

$2\cos\left(\frac{\pi}{3}+x\right)\cos\left(\frac{\pi}{6}-2x\right)=0 \qquad x=\frac{\pi}{2}+\pi k$

$\left[\begin{array}{ll}\cos\left(2x-\frac{\pi}{6}\right)=0 & 2x-\frac{\pi}{6}=\frac{\pi}{2}+\pi k \quad x=\frac{\pi}{3}+\frac{\pi}{2}k\\ \cos\left(\frac{\pi}{3}+x\right)=0 & \frac{\pi}{3}+x=\frac{\pi}{2}+\pi k \quad x=\frac{\pi}{6}+\pi k\end{array}\right.$

д) $\operatorname{tg}2x\cdot\operatorname{tg}x=-3$

$\frac{2\operatorname{tg}^2x}{1-\operatorname{tg}^2x}\cdot\operatorname{tg}x=-3$

$1-\operatorname{tg}^2x\neq 0$

$\operatorname{tg}x\neq\pm 1$

$2\operatorname{tg}^2x=-3+3\operatorname{tg}^2x$

$\operatorname{tg}^2x=3 \qquad \left[\begin{array}{l}\operatorname{tg}x=\sqrt{3}\\ \operatorname{tg}x=-\sqrt{3}\end{array}\right.$

а) $\cos\left(4x+\frac{\pi}{6}\right)+\cos\left(2x+\frac{\pi}{6}\right)=\cos\left(\frac{\pi}{2}+2x\right)$

$2\cos\left(3x+\frac{\pi}{6}\right)\cos 1x = -\sin 2x$

$2\cos\left(3x+\frac{\pi}{6}\right)\cos x + 2\sin x\cos x = 0.$

$2\cos x\left(2\cos\left(3x+\frac{\pi}{6}\right)+2\sin x\right)=0$

$\left[\begin{array}{ll} \cos x = 0 & x=\frac{\pi}{2}+\pi k \\ \cos\left(\frac{\pi}{6}+3x\right)+\sin x = 0 & \end{array}\right.$

$\cos\left(\frac{\pi}{6}+3x\right)+\cos\left(\frac{\pi}{2}-x\right)=0.$

$2\cos\left(\frac{\pi}{3}+x\right)\cos\left(\frac{\pi}{6}-2x\right)=0 \qquad x=\frac{\pi}{2}+\pi k$

$\left[\begin{array}{ll} \cos\left(2x-\frac{\pi}{6}\right)=0 & 2x-\frac{\pi}{6}=\frac{\pi}{2}+\pi k \quad x=\frac{\pi}{3}+\frac{\pi}{2}k \\ \cos\left(\frac{\pi}{3}+x\right)=0 & \frac{\pi}{3}+x=\frac{\pi}{2}+\pi k \quad x=\frac{\pi}{6}+\pi k \end{array}\right.$

б) $tg2x\cdot tgx=-3$

$\frac{2tg^2x}{1-tg^2x}\cdot tgx=-3$

$1-tg^2x\neq 0$

$tgx\neq\pm 1$

$2tg^2x=-3+3tg^2x$

$tg^2x=3 \qquad \left[\begin{array}{l} tgx=\sqrt{3} \\ tgx=-\sqrt{3} \end{array}\right.$

353.

а) $\begin{cases} tg3x + tg6x = 1 \\ tg3x + \dfrac{tg^2 3x}{1 - tg^2 3x} = 1 \end{cases}$

$tg3x + \cos 6x = 1$

$tg3x = 1 - \cos 6x$

$tg3x = 2\sin^2 3x$

$\dfrac{\sin 3x}{\cos 3x} = 2\sin^2 3x \qquad \cos 3x \neq 0$

$\sin 3x - 2\sin^2 3x \cos 3x = 0$

$\sin 3x (1 - 2\sin 3x \cos 3x) = 0$

$\left[\begin{array}{l} \sin 3x = 0 \\ \sin 6x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{ll} 3x = \pi k & x = \frac{\pi}{3} x \\ 6x = \frac{\pi}{2} + 2\pi k & x = \frac{\pi}{12} + \frac{\pi k}{3} \end{array}\right. \quad k \in Z$

354. $\sin^6 x - \cos^6 x = 1$

$(\sin^2 x - \cos^2 x)(\sin^4 x + 2\sin^2 x \cos^2 x + \cos^4 x) = 1$

$\dfrac{1 - \cos 2x}{2}$ -

$(\sin^2 x)^3 - (\cos^2 x)^3 = 1$

$\left(\dfrac{1 - \cos 2x}{2}\right)^3 - \left(\dfrac{1 + \cos^2 2x}{2}\right)^3 = 1$

$\cos 2x = t$

$$\frac{(1-t)^3 - (1+t)^3}{8} = 1$$

$$1 - 3t + 3t^2 - t^3 - 1 - 3t - 3t^2 - t^3 - 8 = 0$$

$$t^3 + 3t + 4 = 0$$

$$t^3 + 1 + 3(t+1) = 0.$$

$$(t+1)(t^2 - t + 1) + 3(t+1) = 0$$

$$3(t+1)(t^2 - t + 4) = 0.$$

$$\left[\begin{array}{l} t = -1. \\ t^2 - t + 4 = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} t = -1 \\ D < 0 \quad t \in \emptyset. \end{array}\right.$$

$$\cos 2x = -1.$$

$$2x = \pi + 2\pi k$$

$$x = \frac{\pi}{2} + \pi k.$$

$k \in Z.$

355/

$$\sin 3x - \sin 7x = \sqrt{3}\sin 2x.$$

$$-2\sin 2x \cos 5x = \sqrt{3}\sin 2x$$

$$-2\cos 5x = \sqrt{3}$$

$$\cos 5x = -\frac{\sqrt{3}}{2}$$

$$5x = \pm\left(\pi - \frac{\pi}{6}\right) + 2\pi k$$

$$5x = \pm\frac{5\pi}{6} + 2\pi k$$

$$\begin{cases} x = \pm\frac{\pi}{6} + \frac{2\pi}{5}k & k \in z \\ x = \frac{\pi}{2}k \end{cases}$$

е) $(1+\cos 4x)\sin x = \cos^2 2x$

$2\cos^2 2x \sin x - \cos^2 2x = 0$

$\cos^2 2x (2\sin x - 1) = 0$

$$\begin{cases} \cos^2 2x = 0 \\ 2\sin x = 1 \end{cases} \Rightarrow \begin{cases} 2x = \frac{\pi}{2} + \pi k \\ \sin x = \frac{1}{2} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} x = \frac{\pi}{4} + \frac{\pi}{2}k \\ x = (-1)^k \frac{\pi}{6} + \pi k \end{cases}$$

554.

ш) $\cos\frac{\pi}{7}\cos\frac{4\pi}{7}\cos\frac{5\pi}{7} = \frac{1}{8}$

$\left(\cos\frac{\pi}{7}\cos 2\cdot\pi\right)$

$$\frac{\sin\frac{\pi}{7}\cos\frac{\pi}{7}\cos\frac{4\pi}{7}\cos\frac{5\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}$$

$$\frac{\frac{1}{2}\sin\frac{2\pi}{7}\cos\frac{4\pi}{7}\cos\frac{5\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}$$

$$-\frac{\sin\frac{\pi}{7}\cos\frac{\pi}{7}\cos\frac{4\pi}{7}\cdot\cos\frac{2\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$-\frac{\frac{1}{2}\sin\frac{2\pi}{7}\cos\frac{2\pi}{7}\cdot\cos\frac{4\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$-\frac{\frac{1}{4}\sin\frac{4\pi}{7}\cos\frac{4\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$\frac{\frac{1}{8}\sin\frac{8\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$\left(\sin\frac{8\pi}{7} = \sin\frac{\pi}{7}.\right)$$

$$\frac{\frac{1}{8}\sin\left(\frac{8\pi}{7}\right)}{\sin\frac{\pi}{7}} = -\frac{\sin\frac{\pi}{7}}{\sin\frac{\pi}{7}} = -\frac{1}{8}.$$

$$-\frac{\sin\frac{\pi}{7}\cos\frac{\pi}{7}\cos\frac{4\pi}{7}\cos\frac{2\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$-\frac{\frac{1}{2}\sin\frac{2\pi}{7}\cos\frac{2\pi}{7}\cdot\cos\frac{4\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$-\frac{\frac{1}{4}\sin\frac{4\pi}{7}\cos\frac{4\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$\frac{\frac{1}{8}\sin\frac{8\pi}{7}}{\sin\frac{\pi}{7}} = \frac{1}{8}.$$

$$\left(\sin\frac{8\pi}{7} = \sin\frac{\pi}{7}\right)$$

$$\frac{\frac{1}{8}\sin\left(8\frac{\pi}{7}\right)}{\sin\frac{\pi}{7}} = \frac{\sin\frac{\pi}{7}}{\sin\frac{\pi}{7}} = -\frac{1}{8}.$$

а) $\frac{1}{\sin 10^\circ} - 4\sin 70^\circ = 2.$

$$\frac{1 - 4\sin 70^\circ \sin 10^\circ}{\sin 10^\circ} \cdot 2 = \frac{1 - 2(\cos 60^\circ - \cos 80^\circ)}{\sin 10^\circ} =$$

$$= \frac{1 - 2\left(\frac{1}{2} - \sin 10^\circ\right)}{\sin 10^\circ} = \frac{1 - 1 + 2\sin 10^\circ}{\sin 10^\circ} = 2$$

588)

$\cos 4x \neq 0.$

$\sqrt{3}\sin 4x + \cos 4x = 0.$

$\sqrt{3}\,tg\,4x + 1 = 0$

$tg\,4x = -\frac{\sqrt{3}}{3}$

$4x = arctg\left(\frac{\sqrt{3}}{3}\right) + \pi k$

$4x = -\frac{\pi}{6} + \pi k$

$x = -\frac{\pi}{24} + \frac{\pi}{4}k$

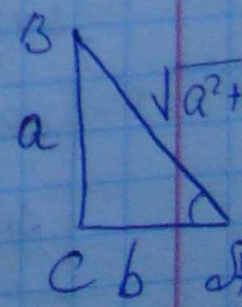
589. а) $3\sin x + 4\sin\left(\frac{\pi}{2} + x\right) = 1.$

$3\sin x + 4\cos x = 1$

$a\sin x + b\cos x = \sqrt{a^2+b^2}\left(\frac{a}{\sqrt{a^2+b^2}}\sin x + \frac{b}{\sqrt{a^2+b^2}}\cos x\right)$

$= \sqrt{a^2+b^2}\cos(x - \varphi)$

$\sin\varphi \quad \cos\varphi$



$\cos\varphi = \frac{b}{\sqrt{a^2+b^2}}$

$\frac{3}{5}\sin x + \frac{4}{5}\cos x = \frac{1}{5}$

$\cos(x-y) = \frac{1}{5}$

$x - y = \pm \arccos\frac{1}{5} + 2\pi k$

$x = \arccos\frac{4}{5} + \arccos\frac{1}{5} + 2\pi k$

592. в) $\cos^2 4x + \cos^2 6x + \cos^2 8x + \cos^2 10x = 2$

$\frac{1+\cos 8x}{2} + \frac{1+\cos 12x}{2} + \frac{1+\cos 16x}{2} + \frac{1+\cos 20x}{2} = 2$

$4 + \cos 8x + \cos 12x + \cos 16x + \cos 20x = 4$

$\cos 8x + \cos 12x + \cos 16x + \cos 20x = 0$

$2\cos 10x \cos 2x + 2\cos 18x \cos 2x = 0$

$\cos 2x (\cos 10x + \cos 18x) = 0$

$\cos 2x$

Между 580 - 601.

26.03.06р.

2/шуд 333

ш) $2\sin^2 x - \sin x = 0$

$\sin x(2\sin x - 1) = 0$

$\begin{cases} \sin x = 0 \\ \sin x = \frac{1}{2} \end{cases} \Rightarrow \begin{cases} x = \pi k & k \in Z \\ x = (-1)^k \frac{\pi}{6} + \pi k & k \in Z \end{cases}$

Ответ: $\pi k; (-1)^k \frac{\pi}{6} + \pi k; k \in Z$

е) $\sqrt{3}\sin x - \sin 2x = 0$

$\sqrt{3}\sin x - 2\sin x \cos x = 0$

$\sin x(\sqrt{3} - 2\cos x) = 0$

$$\begin{cases} \sin x = 0 \\ \cos x = \frac{\sqrt{3}}{2} \end{cases} \Rightarrow \begin{cases} x = \pi k; & k \in Z \\ x = \pm \frac{\pi}{6} + 2\pi k; & k \in Z \end{cases}$$

Ответ: $\pi k; \pm \frac{\pi}{6} + 2\pi k, k \in Z$.

ж) $tg^2 x - tgx = 0$

$tgx(tgx - 1) = 0$

$$\begin{cases} tgx = 0 \\ tgx = 1 \end{cases} \Rightarrow \begin{cases} x = \pi k, & k \in Z \\ x = \frac{\pi}{4} + \pi k, & k \in Z \end{cases}$$

Ответ: $\pi k; \frac{\pi}{4} + \pi k, k \in Z$

з) $5\cos x = \sin 2x$

$5\cos x - 2\sin x \cos x = 0$

$\cos x(5 - 2\sin x) = 0$

$$\begin{cases} \cos x = 0 \\ \sin x = 2{,}5 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{2} + \pi k; & k \in Z \\ x = (-1)^k \arcsin 2{,}5 + \pi k, & k \in Z \end{cases}$$

Ответ: $\frac{\pi}{2} + \pi k; (-1)^k \arcsin 2{,}5 + \pi k; k \in Z$

2/ципd 334

ш) $2\sin x + tg(\pi - x) = 0$

$2\sin x - tgx = 0$

$2\sin x - \frac{\sin x}{\cos x} = 0$

$\sin x \left(2 - \frac{1}{\cos x}\right) = 0$

$tgx\,(2\cos x - 1) = 0$

$$\left[\begin{array}{l} tgx = 0 \\ \cos x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k,\ k \in Z \\ x = \pm\frac{\pi}{3} + 2\pi k,\ k \in Z \end{array}\right.$$

Ответ: $\pi k;\ \pm\frac{\pi}{3} + 2\pi k,\ k \in Z$

л) $ctg\frac{x}{2} + \cos(\pi - x) = 1$

$ctg\frac{x}{2} - \cos x = 1$

$ctg\frac{x}{2} = \frac{1+\cos x}{\sin x}$

$\left(\frac{1+\cos x}{\sin x} - \cos x = 1\right)$

$\left(\frac{1+\cos x - \sin x \cos x}{}\right)$

$ctg\frac{x}{2} = 1 + \cos x$

$ctg\frac{x}{2} = 2\cos^2\frac{x}{2}$

2/ank 334

ш) $2\sin x + tg(\pi - x) = 0$

$2\sin x - tgx = 0$

$2\sin x - \frac{\sin x}{\cos x} = 0$

$\sin x \left(2 - \frac{1}{\cos x}\right) = 0$

$tgx\,(2\cos x - 1) = 0$

$$\left[\begin{array}{l} tgx = 0 \\ \cos x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k,\ k \in Z \\ x = \pm\frac{\pi}{3} + 2\pi k,\ k \in Z \end{array}\right.$$

Ответ: $\pi k;\ \pm\frac{\pi}{3} + 2\pi k,\ k \in Z$

д) $ctg\frac{x}{2} + \cos(\pi - x) = 1$

$ctg\frac{x}{2} - \cos x = 1$

$ctg\frac{x}{2} = \frac{1+\cos x}{\sin x}$

$\left(\frac{1+\cos x}{\sin x} - \cos x = 1\right)$

$\left(\frac{1+\cos x - \sin x \cos x}{}\right)$

$ctg\frac{x}{2} = 1 + \cos x$

$ctg\frac{x}{2} = 2\cos^2\frac{x}{2}$

$$\left(\frac{\cos\frac{x}{2}}{\sin\frac{x}{2}} - 2\cos^2\frac{x}{2}\right) = \cos\frac{x}{2}\left(\frac{1}{\sin\frac{x}{2}} - 2\cos\frac{x}{2}\right)$$

$$ctg\frac{x}{2} - (\cos x + 1) = ctg\frac{x}{2} - 2\cos^2\frac{x}{2} = ctg\frac{x}{2} - 2\sin^2\frac{x}{2}\cdot ctg^2\frac{x}{2} =$$

$$= ctg\frac{x}{2}\left(1 - \sin x\right) = 0$$

$$\left[\begin{array}{l} ctg\frac{x}{2} = 0 \\ \sin x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{l} \frac{x}{2} = \frac{\pi}{2} + \pi k \\ x = \frac{\pi}{2} + 2\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi + 2\pi k,\ k \in Z \\ x = \frac{\pi}{2} + 2\pi k,\ k \in Z \end{array}\right.$$

Ответ: $\frac{\pi}{2} + 2\pi k;\ \pi + 2\pi k,\ k \in Z$

а) $\sqrt{2}\sin\left(x + \frac{\pi}{2}\right) = ctg(x + \pi)$

$$\sqrt{2}\cos x = ctg x$$

$$\frac{\cos x}{\sin x} - \sqrt{2}\cos x = 0$$

$$\frac{\cos x}{\sin x}\left(1 - \sqrt{2}\sin x\right) = 0$$

$$tg x\left(1 - \sqrt{2}\sin x\right) = 0$$

$$\left[\begin{array}{l} tg x = 0 \\ \sin x = \frac{\sqrt{2}}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = (-1)^k\frac{\pi}{4} + \pi k;\ k \in Z \end{array}\right.$$

Ответ: $\pi k;\ (-1)^k\frac{\pi}{4} + \pi k,\ k \in Z$

7) $2\sin x\cos x + 4\cos x = \sin x + 2$

$2\cos x(\sin x + 2) - (\sin x + 2) = 0$

$(\sin x + 2)(2\cos x - 1) = 0$

$$\left[\begin{array}{l}\sin x = -2 \\ \cos x = \frac{1}{2}\end{array}\right. \Rightarrow \left[\begin{array}{l}x \in \emptyset \\ x = \pm\frac{\pi}{3} + 2\pi k,\ k \in Z\end{array}\right.$$

Ответ: $\pm\frac{\pi}{3} + 2\pi k,\ k \in Z$

(учебник 335)

ш) $\sin x * \cos x = 0$

$\sin x + \sin\left(\frac{\pi}{2} - x\right) = 0$

$\sin x + \sin\left(\frac{\pi}{2} - x\right) = 2\sin\frac{\pi}{4}\cos\left(x - \frac{\pi}{4}\right) = \sqrt{2}\cos\left(x - \frac{\pi}{4}\right) = 0$

$\cos\left(x - \frac{\pi}{4}\right) = 0 \Rightarrow x - \frac{\pi}{4} = \frac{\pi}{2} + \pi k \Rightarrow x = \frac{3\pi}{4} + \pi k,\ k \in Z$

Ответ: $\frac{3\pi}{4} + \pi k,\ k \in Z$

е) $\sqrt{3}\cos x - \sin x = 0$

$(\sqrt{3}\cos x - \cos\left(\frac{\pi}{2} - x\right) = 0)$

$\sqrt{3}\cos x = \sqrt{1 - \cos^2 x}$

$3\cos^2 x = 1 - \cos^2 x$

$4\cos^2 x = 1$

$\cos x = \pm\frac{1}{2}$

2/вар № 335

ш) $\sin x + \cos x = 0$

р.ш.р. $\cos x \neq 0$

$\cos x (tg x + 1) = 0$

$$\left[\begin{array}{l} \cos x = 0 \\ tg x = -1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k, \ k \in Z \\ x = -\frac{\pi}{4} + \pi k, \ k \in Z \end{array}\right. \quad x \in \varnothing$$

Ответ: $-\frac{\pi}{4} + \pi k, \ k \in Z$

щ) $\sqrt{3}\cos x - \sin x = 0$

$\cos x (\sqrt{3} - tg x) = 0$

р. ш. р. $\cos x \neq 0$

$$\left[\begin{array}{l} \cos x = 0 \\ tg x = \sqrt{3} \end{array}\right. \Rightarrow \left[\begin{array}{l} x \in \varnothing \\ x = \frac{\pi}{3} + \pi k, \ k \in Z \end{array}\right.$$

Ответ: $\frac{\pi}{3} + \pi k, \ k \in Z$

э) $\cos x - 2\sin x = 0$

$\cos x (1 - 2tg x) = 0$

р. ш. р. $x \in R / \{\frac{\pi}{2} + \pi k\}$

$$\left[\begin{array}{l} \cos x = 0 \\ tg x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x \in \varnothing \\ x = arctg\frac{1}{2} + \pi k, \ k \in Z \end{array}\right.$$

Ответ: $arctg\frac{1}{2} + \pi k, \ k \in Z$

я) $4\cos x + \sin x = 0$

$\cos x (4 + tg x) = 0$

р.ш. р. $\cos x \neq 0$

$$\begin{cases} \cos x = 0 \\ 4 + \operatorname{tg} x = 0 \end{cases} \Rightarrow \begin{cases} x \in \emptyset \\ x = -\operatorname{arctg} 4 + \pi k, \ k \in Z \end{cases}$$

Ответ: $-\operatorname{arctg} 4 + \pi k, \ k \in Z$

№ 336

в) $\sin 8x + \sin 2x = 0$

$\sin 8x + \sin 2x = 2 \sin 5x \cos 3x = 0$

$$\begin{cases} \sin 5x = 0 \\ \cos 3x = 0 \end{cases} \Rightarrow \begin{cases} 5x = \pi k \\ 3x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{5} k, \ k \in Z \\ x = \frac{\pi}{6} + \frac{\pi}{3} k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{5} k; \ \frac{\pi}{6} + \frac{\pi}{3} k, \ k \in Z$

г) $\cos 5x + \cos 9x = 0$

$2 \cos 7x \cos 2x = 0$

$$\begin{cases} \cos 7x = 0 \\ \cos 2x = 0 \end{cases} \Rightarrow \begin{cases} 7x = \frac{\pi}{2} + \pi k \\ 2x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{14} + \frac{\pi k}{7}, \ k \in Z \\ x = \frac{\pi}{4} + \frac{\pi}{2} k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{4} + \frac{\pi}{2} k, \ \frac{\pi}{14} + \frac{\pi}{7} k, \ k \in Z$

д) $\sin 7x = \sin(\pi - 3x)$

$\sin 7x - \sin 3x = 0 \quad 2 \sin 2x \cos 5x = 0$

$$\begin{cases} \cos x = 0 \\ 4 + \operatorname{tg} x = 0 \end{cases} \Rightarrow \begin{cases} x \in \varnothing \\ x = -\operatorname{arctg} 4 + \pi k,\ k \in Z \end{cases}$$

Ответ: $-\operatorname{arctg} 4 + \pi k,\ k \in Z$

№ 336

в) $\sin 8x + \sin 2x = 0$

$\sin 8x + \sin 2x = 2 \sin 5x \cos 3x = 0$

$$\begin{cases} \sin 5x = 0 \\ \cos 3x = 0 \end{cases} \Rightarrow \begin{cases} 5x = \pi k \\ 3x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{5} k,\ k \in Z \\ x = \frac{\pi}{6} + \frac{\pi}{3} k,\ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{5} k;\ \frac{\pi}{6} + \frac{\pi}{3} k,\ k \in Z$

г) $\cos 5x + \cos 9x = 0$

$2 \cos 7x \cos 2x = 0$

$$\begin{cases} \cos 7x = 0 \\ \cos 2x = 0 \end{cases} \Rightarrow \begin{cases} 7x = \frac{\pi}{2} + \pi k \\ 2x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{14} + \frac{\pi k}{7},\ k \in Z \\ x = \frac{\pi}{4} + \frac{\pi}{2} k,\ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{4} + \frac{\pi}{2} k,\ \frac{\pi}{14} + \frac{\pi}{7} k,\ k \in Z$

д) $\sin 7x = \sin(\pi - 3x)$

$\sin 7x - \sin 3x = 0$ $2 \sin 2x \cos 5x = 0$

$$\begin{cases} \sin 2x = 0 \\ \cos 5x = 0 \end{cases} \Rightarrow \begin{cases} 2x = \pi k \\ 5x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{2} k, \ k \in Z \\ x = \frac{\pi}{10} + \frac{\pi}{5} k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{2} k; \ \frac{\pi}{10} + \frac{\pi}{5} k, \ k \in Z$

п) $\cos 6x = \sin\left(\frac{\pi}{2} + 4\pi\right)$

$\cos 6x - \cos 4x = 0 \Leftrightarrow 2 \sin 5x \cdot \sin x = 0$

$$\begin{cases} \sin x = 0 \\ \sin 5x = 0 \end{cases} \Rightarrow \begin{cases} x = \pi k \\ 5x = \pi k \end{cases} \Rightarrow \begin{cases} x = \pi k, \ k \in Z \\ x = \frac{\pi}{5} k, \ k \in Z \end{cases}$$

Ответ: $\pi k; \ \frac{\pi}{5} k, \ k \in Z$

ф) $\sin 9x - \cos x = 0$

$\sin 9x - \sin\left(\frac{\pi}{2} - x\right) = 2 \sin\left(5x - \frac{\pi}{4}\right) \cos\left(4x + \frac{\pi}{4}\right)$

$$\begin{cases} \sin\left(5x - \frac{\pi}{4}\right) = 0 \\ \cos\left(4x + \frac{\pi}{4}\right) = 0 \end{cases} \Rightarrow \begin{cases} 5x - \frac{\pi}{4} = \pi k \\ 4x + \frac{\pi}{4} = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{20} + \frac{\pi}{5} k, \ k \in Z \\ x = \frac{\pi}{16} + \frac{\pi}{4} k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{20} + \frac{\pi}{5} k; \ \frac{\pi}{16} + \frac{\pi}{4} k, \ k \in Z$

ч) $\sin 2x + \cos 6x = 0$

$\sin 2x + \cos 6x = \cos\left(\frac{\pi}{2} - 2x\right) + \cos 6x = 2 \cos\left(\frac{\pi}{4} + 2x\right) \cos\left(\frac{\pi}{4} - 4x\right) = 0$

$$\begin{cases} \cos\left(\frac{\pi}{4} + 2x\right) = 0 \\ \cos\left(\frac{\pi}{4} - 4x\right) = 0 \end{cases} \Rightarrow \begin{cases} \frac{\pi}{4} + 2x = \frac{\pi}{2} + \pi k \\ \frac{\pi}{4} - 4x = \frac{\pi}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{8} + \frac{\pi}{2} k, \ k \in Z \\ x = -\frac{\pi}{16} + \frac{\pi}{4} k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{8}+\frac{\pi}{2}k;\ -\frac{\pi}{16}-\frac{\pi}{4}k,\ k\in Z$;

№ 337

в) $\cos x-\sqrt{3}\sin x=\sqrt{2}$

$\cos x-\sqrt{3}\sin x=\frac{1}{2}\cos x-\frac{\sqrt{3}}{2}\sin x=\frac{\sqrt{2}}{2}\cos\frac{\pi}{3}\cos x-\sin\frac{\pi}{3}\sin x=$

$=\cos\left(\frac{\pi}{3}+x\right)=\frac{\sqrt{2}}{2}$

$\frac{\pi}{3}+x=\pm\frac{\pi}{4}+2\pi k \Rightarrow x=\frac{\pi}{3}\pm\frac{\pi}{4}+2\pi k,\ k\in Z$

$\left[\begin{array}{l} x=\frac{\pi}{3}+\frac{\pi}{4}+2\pi k \\ x=\frac{\pi}{3}-\frac{\pi}{4}+2\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x=\frac{7\pi}{12}+2\pi k,\ k\in Z \\ x=\frac{\pi}{12}+2\pi k,\ k\in Z \end{array}\right.$

Ответ: $\frac{7\pi}{12}+2\pi k;\ \frac{\pi}{12}+2\pi k,\ k\in Z$

г) $\cos 2x+\sin 2x=1$

$(\cos^2 x+2\sin x\cos x-\sin^2 x=1$

$(\cos x-\sin x)^2=1$

$\cos x-\sin x=1)$

$\cos 2x+\sin 2x=\frac{1}{\sqrt{2}}\cos 2x+\frac{1}{\sqrt{2}}\sin 2x=\cos\frac{\pi}{4}\cos 2x+\sin\frac{\pi}{4}\sin 2x=$

$=\cos\left(\frac{\pi}{4}-2x\right)=\frac{\sqrt{2}}{2}$

$\frac{\pi}{4}-2x=\pm\frac{\pi}{4}+2\pi k$

$2x=\frac{\pi}{4}\pm\frac{\pi}{4}-2\pi k \Rightarrow x=\frac{\pi}{8}\pm\frac{\pi}{8}-\pi k$

$$\begin{cases} x = \frac{\pi}{8} + \frac{\pi}{8} - \pi k \\ x = \frac{\pi}{8} - \frac{\pi}{8} - \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{4} - \pi k, \ k \in Z \\ x = -\pi k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{4} - \pi k; -\pi k, k \in Z$

г) $\cos x + \sin(-x) = -\sqrt{2}$

$$\cos x - \sin x = \frac{\sqrt{2}}{2}\cos x - \frac{\sqrt{2}}{2}\sin x = \cos\left(\frac{\pi}{4} + x\right) = -1$$

$$\frac{\pi}{4} + x = \pm(\pi - 0) + 2\pi k = \pm\pi + 2\pi k$$

$$x = -\frac{\pi}{4} \pm \pi + 2\pi k, \ k \in Z$$

$$\begin{cases} x = -\frac{\pi}{4} - \pi + 2\pi k \\ x = -\frac{\pi}{4} + \pi + 2\pi k \end{cases} \Rightarrow \begin{cases} x = -\frac{5\pi}{4} + 2\pi k, \ k \in Z \\ x = \frac{3\pi}{4} + 2\pi k, \ k \in Z \end{cases}$$

Ответ: $-\frac{5\pi}{4} + 2\pi k; \frac{3\pi}{4} + 2\pi k, k \in Z$

д) $\sqrt{3}\cos x - 2\sin\frac{\pi}{6}\sin x = 2$

$$\sqrt{3}\cos x - \sin x = \frac{\sqrt{3}}{2}\cos x - \frac{1}{2}\sin x = \cos\frac{\pi}{6}\cos x - \sin\frac{\pi}{6}\sin x =$$

$$= \cos\left(\frac{\pi}{6} + x\right) = 1$$

$$\frac{\pi}{6} + x = \pm 0 + 2\pi k$$

$$x = -\frac{\pi}{6} + 2\pi k, \ k \in Z$$

Ответ: $-\frac{\pi}{6} + 2\pi k, \ k \in Z$.

2/шрд 338

ш) $\sin(\pi+3x)+\cos(\pi-3x)=\sqrt{1,5}$

$\sin 3x+\cos 3x=\sqrt{1,5}$

$\cos\left(\frac{\pi}{4}-3x\right)=\sqrt{\frac{3}{4}}=\frac{\sqrt{3}}{2}$

$\frac{\pi}{4}-3x=\pm\frac{\pi}{6}+2\pi k$

$$\begin{cases} x=\frac{\pi}{12}+\frac{\pi}{18}+\frac{2}{3}\pi k \\ x=\frac{\pi}{12}-\frac{\pi}{18}+\frac{2}{3}\pi k \end{cases} \Rightarrow \begin{cases} x=\frac{5\pi}{36}+\frac{2\pi}{3}k,\ k\in Z \\ x=\frac{\pi}{36}+\frac{2\pi}{3}k,\ k\in Z \end{cases}$$

Ответ: $\frac{5\pi}{36}+\frac{2\pi}{3}k;\ \frac{\pi}{36}+\frac{2\pi}{36}k,\ k\in Z$

р) $(\sin(\pi+3x)+\cos(\pi-3x))$

$\sin\frac{x-3\pi}{2}+\sqrt{3}\cos\frac{x+3\pi}{2}=\sqrt{3}$

$-\sin\left(\frac{3}{2}\pi-x\right)+\sqrt{3}\cos\left(\frac{3}{2}\pi+x\right)=$

$=\cos x+\sqrt{3}\cos x=\frac{1}{2}\cos x+\frac{\sqrt{3}}{2}\sin x=\cos\left(\frac{\pi}{3}-x\right)=\frac{\sqrt{3}}{2}$

$\frac{\pi}{3}-x=\pm\frac{\pi}{6}+2\pi k$

$x=\frac{\pi}{3}\pm\frac{\pi}{6}-2\pi k$

$$\begin{cases} x=\frac{\pi}{3}-\frac{\pi}{6}-2\pi k \\ x=\frac{\pi}{3}+\frac{\pi}{6}-2\pi k \end{cases} \Rightarrow \begin{cases} x=\frac{\pi}{6}-2\pi k,\ k\in Z \\ x=\frac{\pi}{2}-2\pi k,\ k\in Z \end{cases}$$

Ответ: $\frac{\pi}{6} - 2\pi k; \frac{\pi}{2} - 2\pi k, k \in Z$

г) $\cos 2x + \cos\left(\frac{\pi}{2} - 2x\right) = \sqrt{2}$

$\cos 2x + \sin 2x = \sqrt{2}$

$\cos\left(\frac{\pi}{4} - 2x\right) = 1 \Rightarrow \frac{\pi}{4} - 2x = \pm \arccos 1 + 2\pi k$

$\frac{\pi}{4} - 2x = 2\pi k$

$2x = \frac{\pi}{4} - 2\pi k$

$x = \frac{\pi}{8} - \pi k, k \in Z$

Ответ: $\frac{\pi}{8} + \pi k, k \in Z$;

№ 339

ш) $\sqrt{3}\cos x + \sin x = 2\cos 3x$

$\cos\left(\frac{\pi}{6} - x\right) = \cos 3x$

$\cos\left(\frac{\pi}{6} - x\right) - \cos 3x = 2\sin\left(\frac{\pi}{12} - 2x\right)\sin\left(\frac{\pi}{12} + x\right)$

$\left[\begin{array}{l} \sin\left(\frac{\pi}{12} - 2x\right) = 0 \\ \sin\left(\frac{\pi}{12} + x\right) = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} \frac{\pi}{12} - 2x = \pi k \\ \frac{\pi}{12} + x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{24} + \frac{\pi}{2}k, k \in Z \\ x = -\frac{\pi}{12} + \frac{\pi}{2}k, k \in Z \end{array}\right.$

Ответ: $\frac{\pi}{24} + \frac{\pi}{2}k, k \in Z$

$-\frac{\pi}{12} + \pi k, k \in Z$

е) $\cos x + \sin x = \sqrt{2}\sin 3x$

$\cos\left(\frac{\pi}{4} - x\right) = \sin 3x$

$\cos\left(\frac{\pi}{4} - x\right) - \cos\left(\frac{\pi}{2} - 3x\right) = 0$

$2\sin\left(-\frac{\pi}{8} + x\right)\sin\left(\frac{3\pi}{8} - 2x\right) = 0$

$$\left[\begin{array}{l} \sin\left(-\frac{\pi}{8} + x\right) = 0 \\ \sin\left(\frac{3\pi}{8} - 2x\right) = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} -\frac{\pi}{8} + x = \pi k \\ \frac{3\pi}{8} - 2x = \pi k \end{array}\right. \Rightarrow$$

$$\Rightarrow \left[\begin{array}{l} x = \frac{\pi}{8} + \pi k, \ k \in Z \\ x = \frac{3\pi}{16} + \frac{\pi}{2}k, \ k \in Z \end{array}\right.$$

Ответ: $\frac{\pi}{8} + \pi k; \ \frac{3\pi}{16} + \frac{\pi}{2}k; \ k \in Z$

ж) $\cos 7x - \sin 5x = \sqrt{3}(\cos 5x - \sin 7x)$

$\cos 7x - \cos\left(\frac{\pi}{2} - 5x\right) = \sqrt{3}\left(\cos 5x - \cos\left(\frac{\pi}{2} - 7x\right)\right)$

$2\sin\left(6x - \frac{\pi}{4}\right)\sin\left(\frac{\pi}{4} + x\right) = \sqrt{3}\left(2\sin\left(6x - \frac{\pi}{4}\right)\sin\left(\frac{\pi}{4} - x\right)\right)$

$\sin\left(\frac{\pi}{4} + x\right) = \sqrt{3}\sin\left(\frac{\pi}{4} - x\right)$

$\left(\sqrt{3}\sin\left(\frac{\pi}{4} - x\right) - \sin\left(\frac{\pi}{4} + x\right) = 0\right)$

$\frac{\sin\left(\frac{\pi}{4} + x\right)}{\cos\left(\frac{\pi}{4} + x\right)} = \sqrt{3}$

$tg\left(\frac{\pi}{4} + x\right) = \sqrt{3}$

$\frac{\pi}{4} + x = \frac{\pi}{3} + \pi k$

$x = \frac{\pi}{12} + \pi k,\ k \in Z$

Ответ: $\frac{\pi}{12} + \pi k,\ k \in Z$.

№ 340

а) $3\cos 5x + 4\cos\left(\frac{\pi}{2} + 5x\right) = 5$

$3\cos 5x - 4\sin 5x = 5$

$\frac{3}{5}\cos 5x - \frac{4}{5}\sin 5x = 1$ $\quad \sin\varphi = \frac{4}{5};\ \cos\varphi = \frac{3}{5}$

$\cos(\varphi + 5x) = 1$

$\varphi + 5x = 2\pi k$

$x = -\frac{\varphi}{5} + \frac{2\pi}{5}k = -\frac{1}{5}\operatorname{arctg}\frac{4}{3} + \frac{2\pi}{5}k,\ k \in Z$

Ответ: $-\frac{1}{5}\operatorname{arctg}\frac{4}{3} + \frac{2\pi}{5}k$

б) $12\sin x + 5\sin\left(\frac{3\pi}{2} + x\right) = 6{,}5$

$12\sin x - 5\cos x = 6{,}5$ $\quad \sin\varphi = \frac{12}{13}\quad \cos\varphi = \frac{5}{13}$

$\frac{12}{13}\sin x - \frac{5}{13}\cos x = \frac{1}{2}$

$-\cos(\varphi + x) = \frac{1}{2}$

$\varphi + x = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k$

$\varphi + x = \pm\frac{2\pi}{3} + 2\pi k$, учитывая $\varphi = \operatorname{arctg}\frac{12}{5}$

$x = -\operatorname{arctg}\frac{12}{5} \pm \frac{2\pi}{3} + 2\pi k,\ k \in Z$

Ответ: $\pm\frac{2\pi}{3} - \operatorname{arctg}\frac{12}{5} + 2\pi k,\ k \in Z$

Задача 341

а) $2\sin^2 x + \sin x - 1 = 0$

$D = 1 + 8 = 9$

$\sin x_{1;2} = \frac{-1 \pm 3}{4}$ $\begin{matrix} -1 \\ 0{,}5 \end{matrix}$

$$\begin{cases} \sin x = -1 \\ \sin x = 0{,}5 \end{cases} \Rightarrow \begin{cases} x = -\frac{\pi}{2} + 2\pi k,\ k \in Z \\ x = (-1)^k \frac{\pi}{6} + \pi k;\ k \in Z \end{cases}$$

Ответ: $-\frac{\pi}{2} + 2\pi k;\ (-1)^k \frac{\pi}{6} + \pi k,\ k \in Z$

б) $3\sin^2 x - 5\sin x - 2 = 0$

$D = 25 + 24 = 49$

$\sin x_{1;2} = \frac{5 \pm 7}{6}$ $\begin{matrix} -\frac{1}{3} \\ 2 \end{matrix}$

$$\begin{cases} \sin x = -\frac{1}{3} \\ \sin x = 2 \end{cases} \Rightarrow \begin{cases} x = (-1)^{k+1} \arcsin\frac{1}{3} + \pi k;\ k \in Z \\ x \in \varnothing. \end{cases}$$

Ответ: $(-1)^{k+1} \arcsin\frac{1}{3} + \pi k$

№ 580

ш) $\arcsin 1 - 2\arccos\left(-\frac{\sqrt{2}}{2}\right) = \frac{\pi}{2} - 2\left(\pi - \frac{\pi}{4}\right) = \frac{\pi}{2} - \frac{3\pi}{2} = -\pi$

е) $2\arccos\left(-\frac{\sqrt{3}}{2}\right) + \arcsin\frac{\sqrt{2}}{2} = 2\left(\pi - \frac{\pi}{6}\right) + \frac{\pi}{4} = \frac{5\pi}{3} + \frac{\pi}{4} = \frac{23}{12}\pi$

ж) $\operatorname{arctg}\left(-\frac{1}{\sqrt{3}}\right) + \arccos\frac{\sqrt{2}}{2} = -\frac{\pi}{6} + \frac{\pi}{4} = \frac{\pi}{12}$

з) $\arcsin\left(-\frac{1}{2}\right) - \operatorname{arctg}\sqrt{3} = \pi - \frac{\pi}{6} - \frac{\pi}{3} = \frac{\pi}{2}$

№ 581

ш) $\sin\left(\pi + \arccos\left(-\frac{\sqrt{2}}{2}\right)\right) = \sin\left(\pi + \pi - \frac{\pi}{4}\right) = \sin\left(\pi + \frac{3\pi}{4}\right) =$

$= -\sin\frac{3\pi}{4} = -\frac{\sqrt{2}}{2}$

е) $\cos\left(\pi - \arcsin\left(-\frac{\sqrt{3}}{2}\right)\right) = \cos\left(\pi + \frac{\pi}{3}\right) = -\cos\frac{\pi}{3} = -\frac{1}{2}$

ж) $\operatorname{ctg}\left(3\arccos\left(-\frac{\sqrt{2}}{2}\right)\right) = \operatorname{ctg}\left(3\left(\pi - \frac{\pi}{4}\right)\right) = 3\operatorname{ctg}\frac{\pi}{4} = -\frac{3\cdot\sqrt{2}}{2}$

з) $\sin\left(3\operatorname{arctg}\left(-\sqrt{3}\right)\right) = \sin(3 \quad -3\sin\frac{\pi}{3} = \frac{-3\sqrt{3}}{2}$

№ 582

ш) $\sin\left(\frac{3\pi}{2} - \arccos\frac{1}{3}\right) = -\cos\left(\arccos\frac{1}{3}\right) = -\frac{1}{3}$

е) $\cos\left(\frac{\pi}{2} + \arcsin\frac{1}{4}\right) = -\sin\left(\arcsin\frac{1}{4}\right) = -\frac{1}{4}$

Упр 583

в) $\sin\left(2\arccos\frac{3}{5}\right) = 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right)$

$\sin\left(2\arccos\frac{3}{5}\right) = 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right) =$

$\sin\left(\arccos\frac{3}{5}\right) \Rightarrow \cos\alpha = \frac{3}{5} \Rightarrow \sin\alpha = \pm\sqrt{1-\frac{9}{25}} = \frac{4}{5} \Rightarrow$

$\Rightarrow 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right) = 2\cdot\frac{4}{5}\cdot\frac{3}{5} = 2\frac{24}{25} = 0{,}96$

г) $\cos\left(\frac{1}{2}\arcsin\frac{4}{5}\right) = \pm\sqrt{\frac{1+\cos\left(\arcsin\frac{4}{5}\right)}{2}} =$

$= \pm\sqrt{\frac{1+\sqrt{1-\frac{16}{25}}}{2}} = \pm\sqrt{\frac{1+3}{10}} = \sqrt{\frac{2}{5}} = \frac{2}{\sqrt{10}} = \frac{2\sqrt{10}}{10} = \frac{\sqrt{10}}{5}$

Упр 584

в) $\sin(\arccos x) = \sqrt{1-x^2}$

$\sin(\arccos x) =$

$\cos\alpha = x \Rightarrow \sin\alpha = \sqrt{1-x^2}$

г) $\sin(\arccos x) = \cos(\arcsin x)$

$\sin(\arccos x) = \sin\alpha$

$\sin\alpha = \sqrt{1-x^2}$

Задача 583

а) $\sin\left(2\arccos\frac{3}{5}\right) = 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right)$

а) $\sin\left(2\arccos\frac{3}{5}\right) = 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right) =$

$\sin\left(\arccos\frac{3}{5}\right) \Rightarrow \cos\alpha = \frac{3}{5} \Rightarrow \sin\alpha = \pm\sqrt{1-\frac{9}{25}} = \frac{4}{5} \Rightarrow$

$\Rightarrow 2\sin\left(\arccos\frac{3}{5}\right)\cos\left(\arccos\frac{3}{5}\right) = 2\cdot\frac{4}{5}\cdot\frac{3}{5} = 2\frac{24}{25} = 0{,}96$

б) $\cos\left(\frac{1}{2}\arcsin\frac{4}{5}\right) = \pm\sqrt{\frac{1+\cos\left(\arcsin\frac{4}{5}\right)}{2}} =$

$= \pm\sqrt{\frac{1+\sqrt{1-\frac{16}{25}}}{2}} = \pm\sqrt{\frac{1+3}{10}} = \sqrt{\frac{2}{5}} = \frac{2}{\sqrt{10}} = \frac{2}{\sqrt{10}} = \frac{2\sqrt{10}}{10} = \frac{\sqrt{10}}{5}$

Задача 584

а) $\sin(\arccos x) = \sqrt{1-x^2}$

$\sin(\arccos x) =$

$\cos\alpha = x \Rightarrow \sin\alpha = \sqrt{1-x^2}$

б) $\sin(\arccos x) = \cos(\arcsin x)$

$\sin(\arccos x) = \sin\alpha$

$\sin\alpha = \sqrt{1-x^2}$

$\frac{\sqrt{10}}{5}$

№ 585

ш) $4\operatorname{arctg}(x^2-4x+4)=\pi$

$x^2-4x+4=0$

$\frac{b}{4}=4-4=0$

$x_{1;2}=x=\frac{4}{2}=2$

$\operatorname{arctg}(x^2-4x+4)=\frac{\pi}{4}$

$x^2-4x+4=1$

$x^2-4x+3=0$

$\frac{b}{4}=4-3=1$

$x_{1;2}=2\pm1 \begin{cases}1\\3\end{cases}$

Ответ: 1; 3.

ғ) $6\operatorname{arctg}(3x^2+x+\sqrt{3})=\pi$

$\operatorname{arctg}(3x^2+x+\sqrt{3})=\frac{\pi}{6}$

$(3x^2+x+\sqrt{3}-\frac{\sqrt{3}}{3}=0)$

$\operatorname{tg}\frac{\pi}{6}=3x^2+x+\sqrt{3}$

$3x^2+x+\frac{\sqrt{3}(3-1)}{3}=0$

~~$D=1$~~

$3x^2+x+\frac{2\sqrt{3}}{3}=0$

$D=1-8\sqrt{3}<0$

$x\in\varnothing$

Упр 586

ш) $\arcsin(2x-1)$ р.о.о.р. $x \in [0;1]$

$-1 \le 2x-1 \le 1$

$0 \le x \le 1$

р) $\arccos \frac{3x-2}{4x+4}$

$$\begin{cases} -1 \le \frac{3x-2}{4x+4} \le 1 \\ 4x+4 \neq 0 \end{cases} \Rightarrow \begin{cases} \frac{3x-2}{4x+4} \ge -1 \\ \frac{3x-2}{4x+4} \le 1 \\ x \neq -1 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \frac{3x-2+4x+4}{4x+4} \ge 0 \\ \frac{3x-2-4x-4}{4x+4} \le 0 \end{cases} \Rightarrow \begin{cases} \left[\begin{array}{l} 7x+2 \ge 0 \\ 4x+4 > 0 \end{array}\right. \\ \left[\begin{array}{l} 7x+2 \le 0 \\ 4x+4 < 0 \end{array}\right. \end{cases} \Rightarrow \begin{cases} \left[\begin{array}{l} x \in [-\frac{2}{7}; +\infty) \\ x \in (-1; +\infty) \end{array}\right. \\ \left[\begin{array}{l} x \in (-\infty; -\frac{2}{7}] \\ x \in (-\infty; -1) \end{array}\right. \end{cases}$$

$$\begin{cases} \left[\begin{array}{l} x+6 \ge 0 \\ 4x+4 > 0 \end{array}\right. \\ \left[\begin{array}{l} x+6 \le 0 \\ 4x+4 < 0 \end{array}\right. \end{cases} \Rightarrow \begin{cases} \left[\begin{array}{l} x \in [-6; +\infty) \\ x \in (-1; +\infty) \end{array}\right. \\ \left[\begin{array}{l} x \in (-\infty; -6] \\ x \in (-\infty; -1) \end{array}\right. \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \left[\begin{array}{l} x \in [-\frac{2}{7}; \infty) \\ x \in (-\infty; -1) \end{array}\right. \\ \left[\begin{array}{l} x \in (-1; +\infty) \\ x \in (-\infty; -6] \end{array}\right. \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -1) \cup [-\frac{2}{7}; \infty) \\ x \in (-\infty; -6] \cup (-1; +\infty) \end{cases} \Rightarrow$$

$\Rightarrow \left[\begin{array}{l} x \in (-\infty; -6] \cup [-\frac{2}{7}; \infty) \end{array}\right.$

Ответ: $x \in (-\infty; -6] \cup [-\frac{2}{7}; +\infty)$.

Упр 586

а) $\arcsin(2x-1)$ р.м.р. $x \in [0;1]$

$-1 \le 2x-1 \le 1$

$0 \le x \le 1$

б) $\arccos \frac{3x-2}{4x+4}$

$$\begin{cases} -1 \le \frac{3x-2}{4x+4} \le 1 \\ 4x+4 \neq 0 \end{cases} \Rightarrow \begin{cases} \frac{3x-2}{4x+4} \ge -1 \\ \frac{3x-2}{4x+4} \le 1 \\ x \neq -1 \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \frac{3x-2+4x+4}{4x+4} \ge 0 \\ \frac{3x-2-4x-4}{4x+4} \le 0 \end{cases} \Rightarrow \begin{cases} \begin{cases} 7x+2 \ge 0 \\ 4x+4 > 0 \end{cases} \\ \begin{cases} 7x+2 \le 0 \\ 4x+4 < 0 \end{cases} \end{cases} \Rightarrow \begin{cases} \begin{cases} x \in [-\frac{2}{7}; +\infty) \\ x \in (-1; +\infty) \end{cases} \\ \begin{cases} x \in (-\infty; -\frac{2}{7}] \\ x \in (-\infty; -1) \end{cases} \end{cases}$$

$$\begin{cases} \begin{cases} x+6 \ge 0 \\ 4x+4 > 0 \end{cases} \\ \begin{cases} x+6 \le 0 \\ 4x+4 < 0 \end{cases} \end{cases} \Rightarrow \begin{cases} \begin{cases} x \in [-6; +\infty) \\ x \in (-1; +\infty) \end{cases} \\ \begin{cases} x \in (-\infty; -6] \\ x \in (-\infty; -1) \end{cases} \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} \begin{cases} x \in [-\frac{2}{7}; \infty) \\ x \in (-\infty; -1) \end{cases} \\ \begin{cases} x \in (-1; +\infty) \\ x \in (-\infty; -6] \end{cases} \end{cases} \Rightarrow \begin{cases} x \in (-\infty; -1) \cup [-\frac{2}{7}; \infty) \\ x \in (-\infty; -6] \cup (-1; +\infty) \end{cases} \Rightarrow$$

$\Rightarrow x \in (-\infty; -6] \cup [-\frac{2}{7}; \infty)$

Ответ: $x \in (-\infty; -6] \cup [-\frac{2}{7}; +\infty)$.

д) $\operatorname{arctg}\dfrac{3x^5}{x^2-1}$

р.ш.р $x^2-1\neq 0$

$x\neq\pm 1 \Rightarrow x\in R\setminus\{1;-1\}$ Ответ $x\in(-\infty;-1)\cup(-1;1)\cup(1;+\infty)$

№ 587.

ш) $2\sin\left(\dfrac{2x}{5}+\dfrac{\pi}{3}\right)-\sqrt{3}=0$

$\sin\left(\dfrac{2x}{5}+\dfrac{\pi}{3}\right)=\dfrac{\sqrt{3}}{2}$

$\dfrac{2x}{5}+\dfrac{\pi}{3}=(-1)^k\dfrac{\pi}{3}+\pi k$

$x=(-1)^k\dfrac{5\pi}{6}-\dfrac{5\pi}{6}+\dfrac{5\pi}{2}k,\ k\in Z.$

ф) $\sqrt{3}\operatorname{tg}\left(\dfrac{5x}{2}+\dfrac{\pi}{6}\right)-1=0$

$\operatorname{tg}\left(\dfrac{5x}{2}+\dfrac{\pi}{6}\right)=\dfrac{1}{\sqrt{3}}$

$\dfrac{5x}{2}+\dfrac{\pi}{6}=\dfrac{\pi}{6}+\pi k$

$x=\dfrac{2\pi}{5}k,\ k\in Z.$

я)

№ 588

ш) $\sqrt{3}\sin 4x+\cos 4x=0$ $\quad\cos 4x\neq 0$

$\sin\dfrac{\pi}{3}\sin 4x+\cos\dfrac{\pi}{3}\cos 4x=0$

$\cos\left(\dfrac{\pi}{3}-4x\right)=0 \Rightarrow \cos\left(4x-\dfrac{\pi}{3}\right)=0$

е) $\operatorname{arctg}\frac{3x^5}{x^2-1}$

о.в.з. $x^2-1\neq 0$

$x\neq\pm 1 \Rightarrow x\in R\setminus\{1;-1\}$ Ответ $x\in(-\infty;-1)\cup(-1;1)\cup(1;+\infty)$

№ 587.

ж) $2\sin\left(\frac{2x}{5}+\frac{\pi}{3}\right)-\sqrt{3}=0$

$\sin\left(\frac{2x}{5}+\frac{\pi}{3}\right)=\frac{\sqrt{3}}{2}$

$\frac{2x}{5}+\frac{\pi}{3}=(-1)^k\frac{\pi}{3}+\pi k$

$x=(-1)^k\frac{5\pi}{6}-\frac{5\pi}{6}+\frac{5\pi}{2}k,\ k\in Z.$

з) $\sqrt{3}\,tg\left(\frac{5x}{2}+\frac{\pi}{6}\right)-1=0$

$tg\left(\frac{5x}{2}+\frac{\pi}{6}\right)=\frac{1}{\sqrt{3}}$

$\frac{5x}{2}+\frac{\pi}{6}=\frac{\pi}{6}+\pi k$

$x=\frac{2\pi}{5}k,\ k\in Z.$

№ 588

ж) $\sqrt{3}\sin 4x+\cos 4x=0$ $\quad\cos 4x\neq 0$

$\sin\frac{\pi}{3}\sin 4x+\cos\frac{\pi}{3}\cos 4x=0$

$\cos\left(\frac{\pi}{3}-4x\right)=0 \Rightarrow \cos\left(4x-\frac{\pi}{3}\right)=0$

$4x - \frac{\pi}{3} = \frac{\pi}{2} + \pi k$

$4x = \frac{\pi}{3} + \frac{\pi}{2} + \pi k = \frac{5\pi}{6} + \pi k$

$x = \frac{5\pi}{24} + \frac{\pi}{4}k, \; k \in z$

Ответ: $\frac{5\pi}{24} + \frac{\pi}{4}k, \; k \in z$

е) $3\sin x + 4\sin\left(\frac{\pi}{2} + x\right) = 0$ $\quad \cos x \neq 0$

$3\sin x + 4\cos x = 0$

$tg\,x = -\frac{4}{3}$

$x = -arctg\frac{4}{3} + \pi k, \; k \in z$ Ответ: $-arctg\frac{4}{3} + \pi k$

№ 589

ж) $\sqrt{3}\sin 4x + \cos 4x = 1.$

$\sin\frac{\pi}{3}\sin 4x + \cos\frac{\pi}{3}\cos 4x = \cos\left(4x - \frac{\pi}{3}\right) = \frac{1}{2}$

$4x - \frac{\pi}{3} = \pm\frac{\pi}{3} + 2\pi k$

$x = \frac{\pi}{12} \pm \frac{\pi}{12} + \frac{\pi}{2}k$

$\left[\begin{array}{l} x = \frac{\pi}{12} + \frac{\pi}{12} + \frac{\pi}{2}k \\ x = \frac{\pi}{12} - \frac{\pi}{12} + \frac{\pi}{2}k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{6} + \frac{\pi}{2}k, \; k \in z \\ x = \frac{\pi}{2}k, \; k \in z \end{array}\right.$

Ответ: $\frac{\pi}{2}k; \; \frac{\pi}{6} + \frac{\pi}{2}k, \; k \in z$

$4x - \frac{\pi}{3} = \frac{\pi}{2} + \pi k$

$4x = \frac{\pi}{3} + \frac{\pi}{2} + \pi k = \frac{5\pi}{6} + \pi k$

$x = \frac{5\pi}{24} + \frac{\pi}{4}k, \; k \in z$

Ответ: $\frac{5\pi}{24} + \frac{\pi}{4}k, \; k \in z$

г) $3\sin x + 4\sin\left(\frac{\pi}{2} + x\right) = 0$ $\quad \cos x \neq 0$

$3\sin x + 4\cos x = 0$

$tg\,x = -\frac{4}{3}$

$x = -arctg\frac{4}{3} + \pi k, \; k \in z$ Ответ: $-arctg\frac{4}{3} + \pi k$

№ 589

а) $\sqrt{3}\sin 4x + \cos 4x = 1.$

$\sin\frac{\pi}{3}\sin 4x + \cos\frac{\pi}{3}\cos 4x = \cos\left(4x - \frac{\pi}{3}\right) = \frac{1}{2}$

$4x - \frac{\pi}{3} = \pm\frac{\pi}{3} + 2\pi k$

$x = \frac{\pi}{12} \pm \frac{\pi}{12} + \frac{\pi}{2}k$

$\left[\begin{array}{l} x = \frac{\pi}{12} + \frac{\pi}{12} + \frac{\pi}{2}k \\ x = \frac{\pi}{12} - \frac{\pi}{12} + \frac{\pi}{2}k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{6} + \frac{\pi}{2}k, \; k \in z \\ x = \frac{\pi}{2}k, \; k \in z \end{array}\right.$

Ответ: $\frac{\pi}{2}k; \; \frac{\pi}{6} + \frac{\pi}{2}k, \; k \in z$

а) $3\sin x + 4\sin\left(\frac{\pi}{2} + x\right) = 1$

$3\sin x + 4\cos x = 1$

$\frac{3}{5}\sin x + \frac{4}{5}\cos x = \sin(\arcsin\frac{3}{5})\sin x + \cos(\arccos\frac{4}{5})\cos x =$

$= \cos\left(x - \arccos\frac{4}{5}\right) = \frac{1}{5}$

$x - \arccos\frac{4}{5} = \pm\arccos\frac{1}{5} + 2\pi k$

$$x = \begin{cases} \arccos\frac{1}{5} + \arccos\frac{4}{5} + 2\pi k, & k \in Z \\ \arccos\frac{4}{5} - \arccos\frac{1}{5} + 2\pi k, & k \in Z \end{cases}$$

б) з/ир 590

ш) $\sin 3\left(x - \frac{5\pi}{2}\right) = 1 + \cos 6x$

$(1 + \cos 6x - \sin 3(x -$

$\sin\left(x - \frac{5\pi}{2}\right) = \sin\left(-\left(\left(2\pi - \frac{\pi}{2}\right) - x\right)\right) = +\sin\left(\frac{\pi}{2} + x\right) = -\cos x$

$(-\cos 3x)$ $1 + \cos 6x + \cos 3x = 0$

$\cos^2 3x - \sin^2 3x + \cos 3x = -1$

$\cos 3x(\cos 3x + 1) -$

$1 + \cos 6x + \cos 3x = 0$

$\cos^2 3x - 1 + 1 + \cos 3x = 0$

$\cos 3x(\cos 3x + 1) = 0 \Rightarrow \begin{cases} \cos 3x = 0 \\ \cos 3x = -1 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{6} + \frac{\pi}{3}k, & k \in Z \\ x = \frac{\pi}{3} + \frac{2\pi}{3}k, & k \in Z \end{cases}$

Ответ: $\frac{\pi}{6} + \frac{\pi}{3}k; \pm\frac{\pi}{3} + \frac{2\pi}{3}k,\ k \in Z$

г) $\sin\frac{x}{4} + \cos\frac{x}{2} - 1 = 0$

$\left(\sin\frac{x}{4} + \cos\frac{x}{2} = \sin\frac{\pi}{4}\sin\frac{x}{4} + \cos\frac{\pi}{4}\cos\frac{x}{4}\right)$

$\cos\frac{x}{2} = 2\cos^2\frac{x}{4} = 2\cos^2\frac{x}{4} - 1$

$\sin\frac{x}{4} + 2\cos^2\frac{x}{4} - 2 = 0 = \sin\frac{x}{4} + 2\left(1 - \sin^2\frac{x}{4}\right) - 2 =$

$= \sin\frac{x}{4} - 2\sin^2\frac{x}{4} = \sin\frac{x}{4}\left(1 - 2\sin\frac{x}{4}\right) = 0$

$\left[\begin{array}{l}\sin\frac{x}{4} = 0\\ \sin\frac{x}{4} = \frac{1}{2}\end{array}\right. \Rightarrow \left[\begin{array}{l}x = 4\pi k,\ k \in Z\\ x = (-1)^k\frac{2\pi}{3} + \pi k,\ k \in Z\end{array}\right.$

Ответ: $4\pi k;\ (-1)^k\frac{2\pi}{3} + \pi k;\ k \in Z$

№ 591

ш) $1 + \cos 4x = \sin 3x - \sin x$

$(1 + \cos 4x - \sin 3x + \sin x = 0)$

$\left(1 + \cos 4x - \cos\left(\frac{\pi}{2} - 3x\right) + \sin x = 2\sin\left(\frac{\pi}{4} + \frac{x}{2}\right)\sin\left(\frac{7}{2}x - \frac{\pi}{4}\right) +\right.$

$+ 1 + \sin x = 2\sin$

$2\cos^2 2x = 2\sin x\cos 2x$

$\cos^2 2x - \sin x\cos 2x = \cos 2x(\cos 2x - \sin x) = 0$

$= \cos 2x\left(1 - 2\sin^2 x - \sin x\right) = \cos 2x\left(1 - \sin x(2\sin x + 1)\right)$

$$\left[\begin{array}{l}\cos 2x = 0\\ \\ \\ \end{array}\right.$$

2 вариант 591

ж) $1+\cos 4x = \sin 3x - \sin x$

$2\cos^2 2x = (2\sin 2x\cos 2x)\ 2\sin x\cos 2x$

$\cos 2x(\cos 2x - \sin x) = 0$

$\cos 2x(1 - 2\sin^2 x - \sin x) = 0$

$\cos 2x(2\sin^2 x + \sin x - 1) = 0$

$$\left[\begin{array}{l}\cos 2x = 0\\ 2\sin^2 x + \sin x - 1 = 0\end{array}\right. \Rightarrow \left\{\begin{array}{l}2x = \frac{\pi}{2} + \pi k\\ \$\end{array}\right.$$

$2\sin^2 x + \sin x - 1 = 0$

$D = 1 + 8 = 9$

$\sin x_{1;2} = \frac{-1 \pm 3}{4} \begin{array}{l}\nearrow -1\\ \searrow 0{,}5\end{array}$

$$\left[\begin{array}{l}2x = \frac{\pi}{2} - \cos 2x = 0\\ \sin x = -1\\ \sin x = 0{,}5\end{array}\right. \Rightarrow \left[\begin{array}{l}2x = \frac{\pi}{2} + \pi k\\ x = (-1)^k \cdot \left(-\frac{\pi}{2}\right) + \pi k\\ x = (-1)^k \cdot \frac{\pi}{6} + \pi k\end{array}\right. \Rightarrow \left\{\begin{array}{l}x = \frac{\pi}{4} + \frac{\pi k}{2},\ k \in ?\\ x = (-1)^{k+1}\frac{\pi}{2} + \pi k,\ k\\ x = (-1)^{k+1}\frac{\pi}{6} + \pi k,\ k\end{array}\right.$$

Ответ: $\frac{\pi}{4} + \frac{\pi k}{2};\ (-1)^{k+1}\frac{\pi}{2} + \pi k;\ (-1)^{k+1}\frac{\pi}{6} + \pi k,\ k \in ?$

г) $1 - \cos 4x = \sin 3x + \sin x$

$2\sin^2 2x = 2\sin 2x \cos x$

$\sin 2x(\sin 2x - \cos x) = 0 \quad \sin 2x(2\sin x \cos x - \cos x) =$

$= \sin 2x \cos x (2\sin x - 1) = 0$

$$\begin{cases} \sin x = 0 \\ \cos x = 0 \\ \sin x = \frac{1}{2} \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{2} k, \ k \in z \\ x = \frac{\pi}{2} + \pi k, \ k \in z \\ x = (-1)^k \frac{\pi}{6} + \pi k, \ k \in z \end{cases}$$

Ответ: $\pi k; \frac{\pi}{2} + \pi k; (-1)^k \frac{\pi}{6} + \pi k, \ k \in z$

Задача 592

ш) $\sin^2 2x + \sin^2 6x + \sin^2 10x + \sin^2 14x = 2$

$(1 - \cos^2 2x + 1 - \cos^2 6x + 1 - \cos^2 10x + 1 - \cos^2 14x =$

$= 4 - 2\sin^2 x \cos^2 x$

$$\frac{1-\cos 4x}{2} + \frac{1-\cos 12x}{2} + \frac{1-\cos 20x}{2} + \frac{1-\cos 28x}{2} =$$

$= 4 - (\cos 4x + \cos 12x + \cos 20x + \cos 28x) = 4$

$\cos(2\cos 8x \cos 4x + 2\cos 3x \cos 17x = 0$

$2\cos 16x \cos 12x + 2\cos 16x \cos 4x = 0$

$2\cos 16x(\cos 12x + \cos 4x) = 2\cos 16x \cos 8x \cos 4x = 0$

$\cos 16x = 2\cos$

(г) $\cos^2 4x + \cos^2 6x + \cos^2 8x + \cos^2 10x = 2$

$\frac{1+\cos 8x}{2}$

$\cos 16x = 0$
$\cos 8x = 0$

$4\cos 4x \cos 8x \cos 16x = \frac{4\cos 4x \sin 4x \cos 8x \cos 16x}{\sin 4x} =$

$= \frac{2\sin 8x \cos 8x \cos 16x}{\sin 4x} = \frac{\sin 16x \cos 16x}{\sin 4x} =$

$= \frac{\sin 32x}{2\sin 4x} = 0 \Rightarrow$

$\Rightarrow \sin 32x = 0 \Rightarrow 32x = \pi k \Rightarrow x = \frac{\pi}{32} k,\ k \in Z$

Ответ: $\frac{\pi}{32} k$

д) $\cos^2 4x + \cos^2 6x + \cos^2 8x + \cos^2 10x = 2$

$1 + \cos 8x + 1 + \cos 12x + 1 + \cos 16x + 1 + \cos 20x = 4$

$\cos 8x + \cos 12x + \cos 16x + \cos 20x = 0$

$2\cos 14x \cos 6x + 2\cos 14x \cos 2x = 0$

$2\cos 14x (\cos 6x + \cos 2x) = 0$

$2\cos 14x \cdot 2\cos 4x \cos 2x = 4\cos 14x \cos 4x \cos 2x = 0$

$\left[\begin{array}{l} \cos 2x = 0 \\ \cos 4x = 0 \\ \cos 14x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 2x = \frac{\pi}{2} + \pi k \\ 4x = \frac{\pi}{2} + \pi k \\ 14x = \frac{\pi}{2} + \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{4} + \frac{\pi}{2} k,\ k \in Z \\ x = \frac{\pi}{8} + \frac{\pi}{4} k,\ k \in Z \\ x = \frac{\pi}{28} + \frac{\pi}{14} k,\ k \in Z \end{array}\right.$

Ответ: $\frac{\pi}{4} + \frac{\pi}{2} k;\ \frac{\pi}{8} + \frac{\pi}{4} k;\ \frac{\pi}{28} + \frac{\pi}{14} k, k \in$

Задача 593

в) $tgx + 3ctgx = 4$

$tg^2x + 3 = 4tgx$

$tg^2x - 4tgx + 3 = 0$

$D = 4 + 3 = 1$

$tgx_{1,2} = 2 \pm 1 \begin{cases} 1 \\ 3 \end{cases}$

$\begin{cases} tgx = 1 \\ tgx = 3 \end{cases} \Rightarrow \begin{cases} x = arctg1 + \pi k \\ x = arctg3 + \pi k \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{4} + \pi k, k \in Z \\ x = arctg3 + \pi k, k \in Z \end{cases}$

Ответ: $\frac{\pi}{4} + \pi k, arctg3 + \pi k, k \in Z$

г) $tgx - 4ctgx = 3$

$tg^2x - 4 = 3tgx$

$tgx - 4ctgx$ $tg^2x - 4 = 3tgx$

$tg^2x - 3tgx + 4 = 0$

$D = 9 + 16 = 25$

$tgx_{1,2} = \frac{3 \pm 5}{2} \begin{cases} -1 \\ 4 \end{cases}$

$\begin{cases} tgx = -1 \\ tgx = 4 \end{cases} \Rightarrow \begin{cases} x = -\frac{\pi}{4} + \pi k, k \in Z \\ x = arctg4 + \pi k, k \in Z \end{cases}$

Ответ: $-\frac{\pi}{4} + \pi k, arctg4 + \pi k, k \in Z$

2/ш 594

ш) $\cos 2x = 3 - 7\cos(3\pi + x)$

$\cos 2x = 5 + 7\cos x$

$2\cos^2 x - 7\cos x - 3 = 0$

$\cos x(2\cos x - 7)$

$D = 14 + 24 = 49$

$\cos x_{1;2} = \frac{7 \pm 7}{4}$ < 0; 7.

$\cos 2x = 3 - 7\cos(3\pi + x)$

$\cos 2x = 3 + 7\cos x$

$\cos 2x - 7\cos x - 3 = 0$

$2\cos^2 x - 1 - 7\cos x - 3 = 0$

$2\cos^2 x - 7\cos x - 4 = 0$

$D = 49 + 32 = 81$

$\cos x_{1;2} = \frac{7 \pm 9}{4}$ < -0,5; 4.

$\begin{cases} \cos x = -0,5 \\ \cos x = 4 \end{cases} \Rightarrow \begin{cases} x = \pi k, k \in Z \\ x \in \emptyset \end{cases}$ $x = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k$; $x = \pm\frac{2\pi}{3} + 2\pi k$

Ответ: $\pi k, k \in Z$;

д) $\sin^4\frac{x}{2} + 5\cos x + 4 = 0$

$1 - \cos^2 x + 10\cos x + 8 = 0$ $\left(\frac{1 - \cos^2 x}{4}\right)^2 + 5\cos x + 4 = 0$

$\cos^2 x - 10\cos x - 9 = 0$

$1 - 2\cos x + \cos^2 x + 20\cos x + 16 = 0$

$D = 100 + 25 + 9 = 36$

$\cos x_{1;2} = \frac{5 \pm 6}{}$ < ~~1~~ -1; 11

$\begin{cases} \cos x = -1 \\ \cos x = 11 \end{cases} \Rightarrow \begin{cases} x = \pm\pi + 2\pi k, k \in Z \\ x \in \emptyset \end{cases}$

Ответ: $\pm\pi + 2\pi k, k \in Z$

2/шт d 595

ш) $\cos 4x = 6\cos^2 x - 5$

$\cos 4x = 3 + 3\cos 2x - 5$

$\cos 4x = 3\cos 2x - 2$

$2\cos^2 2x - 1 - 3\cos 2x + 2 = 0$

$2\cos^2 2x - 3\cos 2x + 1 = 0$

$D = 9 + 8 = 17$

$\cos x_{1;2} = \frac{3 \pm \sqrt{17}}{4} \Big/ \begin{matrix} \frac{3-\sqrt{17}}{4} \\ \frac{3+\sqrt{17}}{4} \end{matrix}$ th ришл.

$\cos 2x = \frac{3-\sqrt{17}}{4}$

$2x = \pm \arccos \frac{3-\sqrt{17}}{4} + 2\pi k$; Ришл! $\pm \arccos \frac{3-\sqrt{17}}{8} + 2\pi k$

ф) $\sin\left(\frac{\pi}{2} + 4x\right) = 1 - 6\sin^2 x$

$\cos 4x = 1 - 3 + \cos 2x$

$2\cos^2 2x - 1 - \cos 2x + 2 = 0$

$2\cos^2 2x - \cos 2x + 1 = 0$

$D = 1 + 8 = 9$

$\cos 2x_{1;2} = \frac{1 \pm 3}{4} \Big/ \begin{matrix} 0,5 \\ 1 \end{matrix}$

$$\left[\begin{array}{l}\cos 2x = -\frac{1}{2}\\ \cos 2x = 1\end{array}\right. \Rightarrow \left[\begin{array}{l}2x = \pm\frac{5\pi}{6} + 2\pi k\\ 2x = 2\pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x = \pm\frac{5\pi}{12} + \pi k,\ k\in Z\\ x = \pi k,\ k\in Z\end{array}\right.$$

Ответ: $\pm\frac{5\pi}{12} + \pi k;\ \pi k,\ k\in Z$

№ 596

в) $2\cos^2 2x - 12\cos^2 x + \cos 4x - 5 = 8\sin\left(\frac{5\pi}{2} + 2x\right)$

$1 + \cos 4x - 6 - \cos 2x + \cos 4x - 1 = 8\cos 2x$

$9\cos 2x - 2\cos 4x + 6 = 0$

$9\cos 2x - 2(2\cos^2 2x - 1) + 6 = 9\cos 2x - 4\cos^2 2x + 8 = 0$

$4\cos^2 2x - 9\cos 2x - 8 = 0$

$D = 81 + 128 = 209$

$\cos 2x_{1,2} = \frac{9 \pm \sqrt{209}}{8}$ / $\frac{9-\sqrt{209}}{8}$ / $\frac{9+\sqrt{209}}{8}$ — не сост

$2x = \pm \arccos\frac{9-\sqrt{209}}{8} + 2\pi k$

$x = \pm \arccos\frac{9-\sqrt{209}}{16} + \pi k,\ k\in Z$

Ответ: $\pm \arccos\frac{9-\sqrt{209}}{16} + \pi k$

е) $2\cos^2 2x - 2\cos 4x + 4\sin^2 x + 2\cos 2x - 5 = 2\cos\left(\frac{5\pi}{2} - 2x\right)$

$1 + \cos 4x - 2\cos 4x + 2 - 2\cos 2x + 2\cos 2x - 5 = 2\sin 2x$

$2\sin 2x + \cos 4x + 2 = 0$

$2\sin 2x + 1 - 2\sin^2 2x + 2 = 0$

$2\sin^2 2x - 2\sin 2x - 3 = 0$

$\frac{D}{4} = \frac{4 + 24}{4} = (4 + 24 = 28)$ $1 + 6 = 7$

$\sin 2x_{1;2} = \frac{1 \pm \sqrt{7}}{2}$ $\begin{cases} \frac{1 - \sqrt{7}}{2} \\ \frac{1 + \sqrt{7}}{2} \end{cases}$

$\begin{cases} 2x = (-1)^k \arcsin\frac{1 - \sqrt{7}}{2} + \pi k \\ 2x = (-1)^k \arcsin\frac{1 + \sqrt{7}}{2} + \pi k \end{cases} \Rightarrow \begin{cases} x = (-1)^k \arcsin\frac{1 - \sqrt{7}}{4} + \frac{\pi}{2} k \\ x = (-1)^k \arcsin\frac{1 + \sqrt{7}}{4} + \frac{\pi}{2} k \end{cases}$

2/вар d 597

ш) $\cos^2 x - 7\sin^2 x = 6\sin x \cos x$

$\frac{1 + \cos 2x}{2} - \frac{7(1 + \cos 2x)}{2} = 3\sin 2x$

$1 + \cos 2x - 7 + 7\cos 2x = 6\sin 2x$

$8\cos 2x - 6\sin 2x = 6$

$4\cos 2x - 3\sin 2x = 3$

$\arccos\frac{4}{5}\cos 2x - \arcsin\frac{3}{5}\sin 2x = \frac{3}{5}$

$\cos\left(\arccos\frac{4}{5}+2x\right)=\frac{3}{5}$

$\arccos\frac{4}{5}+2x=\pm\arccos\frac{3}{5}+2\pi k$

$x=\pm\arccos\frac{3}{10}-\arccos\frac{2}{5}+\pi k,\ k\in Z$

Ответ: $x=\pm\arccos\frac{3}{10}-\arccos\frac{2}{5}+\pi k,\ k\in Z;$

~~в)~~ $\sin^2x+9\cos^2x$)

ж) $\cos^2x-7\sin^2x-6\sin x\cos x=0$

$7\sin^2x+6\sin x\cos x-\cos^2x=0$ $\quad\cos x\neq 0$

$7\operatorname{tg}^2x+6\operatorname{tg}x-1=0$

$D=36+28=64$

$\operatorname{tg}x_{1;2}=\frac{-6\pm 8}{14}\begin{matrix}\nearrow -1\\ \searrow \frac{1}{7}\end{matrix}$

$\left[\begin{array}{l} x=-\frac{\pi}{4}+\pi k,\ k\in Z \\ x=\operatorname{arctg}\frac{1}{7}+\pi k,\ k\in Z \end{array}\right.$

Ответ: $-\frac{\pi}{4}+\pi k,\ \operatorname{arctg}\frac{1}{7}+\pi k,\ k\in Z$

з) $3\sin^2x+9\cos^2x=5\sin 2x$

$3\sin^2x+10\sin x\cos x+9\cos^2x=0$ $\quad\cos x\neq 0$

$\operatorname{tg}^2x-10\operatorname{tg}x+9=0$

$D=25-9=16$ $\quad\operatorname{tg}x_{1,2}=\frac{5\pm 4}{2}\begin{matrix}\nearrow 9\\ \searrow 1\end{matrix}$

$$\begin{cases} x = \frac{\pi}{4} + \pi k, \ k \in Z \\ x = arctg\, 9 + \pi k, \ k \in Z \end{cases}$$

Ответ: $\frac{\pi}{4} + \pi k;\ arctg\, 9 + \pi k,\ k \in Z$

№ 598

а) $10\sin^2 x - 6\sin 2x - 11\cos^2 x = 1$

$10\sin^2 x - 12\sin x \cos x - 11\cos^2 x = \sin^2 x - \cos^2 x = 0$

$9\sin^2 x - 12\sin x \cos x - 12\cos^2 x = 0$

$\cos x \neq 0$

$\frac{:}{}$

$9tg^2 x - 12tg x - 12 = 0$

$\frac{D}{4} = 36 + 12 \cdot 9 = 12(3+9) = 12^2$

$tg x_{1;2} = \frac{6 \pm 12}{18}$ $\begin{matrix} -\frac{1}{3} \\ 1 \end{matrix}$

$$\begin{cases} x = -arctg\frac{1}{3} + \pi k, \ k \in Z \\ x = \frac{\pi}{4} + \pi k, \ k \in Z \end{cases}$$

Ответ: $-arctg\frac{1}{3} + \pi k;\ \frac{\pi}{4} + \pi k, k \in Z$

а) $4\sin^2 x - 3\sin x\cos x + 5\cos^2 x = 3$

$4\sin^2 x - 3\sin x\cos x + 5\cos^2 x - 3\sin^2 x - 3\cos^2 x = 0$

$\sin^2 x - 3\sin x\cos x + 2\cos^2 x = 0$

$\operatorname{tg}^2 x - 3\operatorname{tg} x + 2 = 0 \qquad \cos x \neq 0$

$b = 9 - 8 = 1$

$\operatorname{tg} x_{1;2} = \frac{3 \pm 1}{2} \begin{matrix} \nearrow 1 \\ \searrow 2 \end{matrix}$

$$\left[\begin{array}{l} x = \frac{\pi}{2} + \pi k, \ k \in Z \\ x = \operatorname{arctg} 2 + \pi k, \ k \in Z \end{array}\right.$$

Ответ: $\frac{\pi}{2} + \pi k;\ \operatorname{arctg} 2 + \pi k,\ k \in Z$

2/упр 599

ж) $2\cos x - 3\sin x = |\sin x|$

$\frac{2}{\sqrt{13}}\cos x - \frac{3}{\sqrt{13}}\sin x = \cos\left(x + \operatorname{arctg}\frac{3}{2}\right) = \frac{|\sin x|}{\sqrt{13}}$

2/упр 600

2 ж) $\begin{cases} x - y = 1 \\ \cos \pi x + \sqrt{3} = \cos \pi y \end{cases} \Rightarrow \begin{cases} x - y = 1 \\ 2\sin\frac{\pi(x+y)}{2}\sin\pi\frac{(x-y)}{2} = \sqrt{3} \end{cases} \Rightarrow$

$\Rightarrow \begin{cases} y = x - 1 \\ \sin\left(\pi x - \frac{\pi}{2}\right) = \frac{\sqrt{3}}{2} \end{cases}$

$-\cos \pi x = \frac{\sqrt{3}}{2}$

$$\pi x = \pm\left(\pi - \frac{\pi}{6}\right) + 2\pi k$$

$$x = \pm\frac{5\pi}{6\pi} + 2k = \pm\frac{5}{6} + 2k,\ k \in Z$$

$$y = x - 1 = \pm\frac{5}{6} - 1 + 2k =$$

$$y = \begin{cases} \frac{5}{6} - 1 + 2k = -\frac{1}{6} + 2k \\ -\frac{5}{6} - 1 + 2k = -\frac{11}{6} + 2k \end{cases}$$

$$\begin{cases} x_1 = \frac{5}{6} + 2k, & k \in Z \\ y_1 = -\frac{1}{6} + 2k, & k \in Z \end{cases}$$

$$\begin{cases} x_2 = -\frac{5}{6} + 2k, & k \in Z \\ y_2 = -\frac{11}{6} + 2k, & k \in Z \end{cases}$$

а) $\begin{cases} y - x = 3 \\ \sin \pi x - \sqrt{3} = \sin \pi y \end{cases} \Rightarrow \begin{cases} y - x = 3 \\ 2\sin\frac{\pi(x-y)}{2}\cos\frac{\pi(x+y)}{2} = \sqrt{3} \end{cases} \Rightarrow$

$$\Rightarrow \begin{cases} x - y = -3 \\ -2\sin\frac{3}{2}\cos\left(x + \frac{3}{2}\right) = \sqrt{3} \end{cases} \Rightarrow$$

$$-2\sin\frac{3}{2\pi}$$

$$\begin{cases} y = 3 + x \\ -2\sin\frac{3\pi}{2}\cos\left(\pi x + \frac{3\pi}{2}\right) = \sqrt{3} \end{cases}$$

$$-2 \cdot (-1) \cdot \sin \pi x = \sqrt{3}$$

$$\sin \pi x = \frac{\sqrt{3}}{2}$$

$$\pi x = (-1)^k \frac{\pi}{3} + \pi k$$

$$x = (-1)^k \cdot \frac{1}{3} + k, \quad k \in Z$$

$$y = (-1)^k \cdot \frac{1}{3} + 3 + k, \quad k \in Z$$

Ответ: $\left((-1)^k \cdot \frac{1}{3} + k; (-1)^k \cdot \frac{1}{3} + k + 3\right), \quad k \in Z$

№ 601

$$\begin{cases} y - x = \frac{3}{2}\pi \\ \cos^2 x = 6\sin y - 5 \end{cases} \Rightarrow \begin{cases} y = \frac{3}{2}\pi + x \\ \cos^2 x = -6\cos y - 5 \end{cases}$$

$$\cos^2 x + 6\cos x + 5 = 0$$

$$\frac{D}{4} = 9 - 5 = 4$$

$$(\cos x)_{1;2} = -3 \pm 2 \begin{matrix} -1 \\ -5 \end{matrix}$$

$$\cos x_{1;2} = -3 \pm \sqrt{14} \begin{matrix} -3-\sqrt{14} \\ -3+\sqrt{14} \end{matrix}$$

$$x_1 = \pi + 2\pi k$$

$$x_{1;2} = \pm \arccos(-3-\sqrt{14}) + 2\pi k$$

$$y = \frac{5\pi}{2} + 2\pi k$$

$$x_2 = \pm \arccos(-3+\sqrt{14}) + 2\pi k$$

$$y_1 = \frac{3}{2}\pi + x_1 = \pm \arccos(-3+\sqrt{14}) + 2\pi k + \frac{3}{2}\pi$$

$$y_2 = \frac{3}{2}\pi + x_2 = \pm \arccos(-3+\sqrt{14}) + 2\pi k + \frac{3}{2}\pi$$

Ответ: $\left(\pm\arccos(-3-\sqrt{14})+2\pi k;\ \frac{3}{2}\pi\pm\arccos(-3+\sqrt{14})+\pi k\right)$

$\left(\pm\arccos(-3+\sqrt{14})+2\pi k;\ \frac{3}{2}\pi\pm\arccos(3+\sqrt{14})+\pi k\right)$

4) $\begin{cases} x+y=\frac{\pi}{4} \\ tgx-tgy=2 \end{cases} \Rightarrow \begin{cases} y=\frac{\pi}{4}-x \\ tgx-tg\left(\frac{\pi}{4}-x\right)=2 \end{cases}$

$$tgx-\frac{tg\frac{\pi}{4}-tgx}{1+tg\frac{\pi}{4}tgx}=2$$

$$tgx-\frac{1-tgx}{1+tgx}=\frac{tgx+tg^2x-1+tgx}{1+tgx}=2$$

$$tg^2x+2tgx-1-2-2tgx=0$$

$$tg^2x=3$$

$$tgx=\pm\sqrt{3}$$

$\begin{cases} x_1=\frac{\pi}{3}+\pi k, & k\in Z \\ y_1=\frac{\pi}{4}-\frac{\pi}{3}+\pi k=-\frac{\pi}{12}+\pi k, & k\in Z \end{cases}$ $\quad x_2=-\frac{\pi}{3}+\pi k$ $\quad y_2=\frac{7\pi}{12}+\pi k$

Ответ: $\left(\frac{\pi}{3}+\pi k;-\frac{\pi}{12}+\pi k\right)$ и $\left(-\frac{\pi}{3}+\pi k;\frac{7\pi}{12}+\pi k\right)$

(2 вар d 598 : 2).

ш) Вчера 8 ш

1. $4\cos\left(\frac{7}{2}\pi + \alpha\right) =$

$= 4\cos\left(\frac{3}{2}\pi + \alpha\right) =$

$= 4\sin\alpha =$

$= -4 \cdot \frac{3}{4} = -3$

$\cos\alpha = \frac{\sqrt{7}}{4}, \quad \frac{3}{2}\pi < \alpha < 2\pi$

$\sin\alpha = \sqrt{1 - \frac{7}{16}} = \pm\frac{3}{4}$

$\alpha \in$ IV чет

$\sin\alpha = -\frac{3}{4}$

2. $6\cos\left(\frac{3}{2}\pi - \alpha\right) = -6\sin\alpha =$

$= -6\left(-\frac{5}{8}\right) = \frac{15}{4} = 3{,}75$

$\cos\alpha = \frac{\sqrt{39}}{8}, \quad \frac{3}{2}\pi < \alpha < 2\pi$

$\sin\alpha = \pm\sqrt{1 - \frac{39}{64}} = \pm\frac{5}{8}$

$\alpha \in$ IV чет

$\sin\alpha = -\frac{5}{8}$

3. $\cos\alpha = \frac{\sqrt{17}}{9}; \quad \alpha \in$ IV

$8\left(8\cos\left(\frac{\pi}{2} + \alpha\right) = -8\sin\alpha\right.$

$\sin\alpha = -\sqrt{1 - \frac{17}{81}} = -\frac{8}{9}$

$-8\sin\alpha = -8 \cdot \left(-\frac{8}{9}\right) = \frac{64}{9}$

4. $\cos\alpha = \frac{2}{5}, \quad \alpha \in$ IV чет.

$\frac{15}{\sqrt{21}}\cos\left(\frac{5\pi}{2} + \alpha\right) = \frac{15}{\sqrt{21}}\cos\left(\frac{\pi}{2} + \alpha\right) = -\frac{15}{\sqrt{21}}\sin\alpha =$

$= -\frac{15}{\sqrt{21}} \cdot \sqrt{1 - \frac{225}{25}\,\frac{4}{25}} = -\frac{15}{\sqrt{21}} \cdot \left(-\frac{\sqrt{21}}{5}\right) = 3.$

5. $\cos\alpha = -\frac{4}{7}$, $\alpha \in$ II dum

$$\frac{28}{\sqrt{33}}\cos\left(\frac{3}{2}\pi+\alpha\right) = \frac{28}{\sqrt{33}}\sin\alpha = \frac{28}{\sqrt{33}}\cdot\left(+\frac{\sqrt{33}}{7}\right) = +4$$

6. $\cos\alpha = \frac{4}{5}$; $\alpha \in$ IV dum.

$$\frac{20}{3}\cos\left(\frac{9\pi}{2}+\alpha\right) = -\frac{20}{3}\sin\alpha = -\frac{20}{3}\cdot\left(-\frac{3}{5}\right) = 4$$

7. $\left(\frac{15}{\sqrt{2}}\right)\sin\alpha = -\frac{1}{3}$; $\alpha \in$ III dum.

$$\frac{15}{\sqrt{2}}\cos(\pi+\alpha) = -\frac{15}{\sqrt{2}}\cos\alpha = \frac{15}{\sqrt{2}}\cdot\frac{2\sqrt{2}}{3} = 10$$

8. $\sin\alpha = -\frac{\sqrt{15}}{8}$; $\alpha \in$ III dum.

$$16\cos(3\pi+\alpha) = -16\cos\alpha = -16\cdot\left(-\frac{7}{8}\right) = 14$$

9. $15\cos(2\pi-\alpha)$ $\sin\alpha = \frac{\sqrt{5}}{3}$; $\alpha \in$ II dum.

$$15\cos(2\pi-\alpha) = 15\cos\alpha = -15\cdot\frac{2}{3} = -10$$

$\sin\alpha = \frac{1}{3}$; $\alpha \in$ II.

10. $\frac{6}{\sqrt{2}}\cos\left(\frac{7}{4}\pi-\alpha\right) = \frac{6}{\sqrt{2}}\cos\alpha = \frac{6}{\sqrt{2}}\cdot\left(-\frac{2\sqrt{2}}{3}\right) = -4$

11. $\sin\alpha = \frac{\sqrt{13}}{7}$; $\alpha \in$ I.

$$7\cos(5\pi-\alpha) = -7\cos\alpha = -7\cdot\frac{6}{7} = -6.$$

12. $\sin\alpha = -\frac{1}{5}$, $\alpha \in$ III chorak

$$\frac{5\sqrt{6}}{3}\cos(\pi-\alpha) = -\frac{5\sqrt{6}}{3}\cos\alpha = \frac{5\sqrt{6}}{3}\cdot\frac{2\sqrt{6}}{5} = 4$$

13. $\sin\alpha = -\frac{3}{7}$, $\alpha \in$ III chorak

$$\frac{21}{\sqrt{40}}\cos(\pi-\alpha) = -\frac{21}{\sqrt{40}}\cdot\cos\alpha = \frac{21}{\sqrt{40}}\cdot\frac{\sqrt{40}}{7} = 3.$$

14. $\sin\alpha = \frac{4}{9}$, $\alpha \in$ II chorak.

$$\frac{9}{\sqrt{65}}\cos(\pi+\alpha) = -\frac{9}{\sqrt{65}}\cos\alpha = \frac{9}{\sqrt{65}}\cdot\frac{\sqrt{65}}{9} = 1$$

$\sin\alpha = \frac{1}{4}$, $\alpha \in$ II chorak

15. $\frac{16}{\sqrt{15}}\cos(\pi-\alpha) = -\frac{16}{\sqrt{15}}\cos\alpha = \frac{16}{\sqrt{15}}\cdot\frac{\sqrt{15}}{4} = 4$

16. $7{,}8\sin\left(\frac{3}{2}\pi-\alpha\right) =$ $\sin\alpha = \frac{12}{13}$, $\alpha \in$ II chorak.

$= -7{,}8\cos\alpha = -7{,}8\cdot\left(-\frac{5}{13}\right) = 3$

17. $\sin\alpha = -\frac{3}{5}$, $\alpha \in$ III ch.

$6{,}25\sin\left(\frac{\pi}{2}+\alpha\right) = 6{,}25\cos\alpha = -6{,}25\cdot\frac{4}{5} = -1{,}25\cdot 4 = -5$

18. $\sin\alpha = -\frac{\sqrt{7}}{4}$, $\alpha \in$ IV chorak.

$$4\sin\left(\frac{3}{2}\pi+\alpha\right) = -4\cos\alpha = -4\cdot\frac{3}{4} = -3$$

19. $\sin\alpha = -\frac{\sqrt{21}}{5}$, $\alpha \in$ III chorak

12. $\sin\alpha = -\frac{1}{6}$, $\alpha \in$ III chorak

$\frac{5\sqrt{6}}{3}\cos(\pi-\alpha) = -\frac{5\sqrt{6}}{3}\cos\alpha = \frac{5\sqrt{6}}{3}\cdot\frac{2\sqrt{6}}{6} = 4$

13. $\sin\alpha = -\frac{3}{7}$, $\alpha \in$ III chorak

$\frac{21}{\sqrt{40}}\cos(\pi-\alpha) = -\frac{21}{\sqrt{40}}\cdot\cos\alpha = \frac{21}{\sqrt{40}}\cdot\frac{\sqrt{40}}{7} = 3$.

14. $\sin\alpha = \frac{4}{9}$, $\alpha \in$ II chorak.

$\frac{9}{\sqrt{65}}\cos(\pi+\alpha) = -\frac{9}{\sqrt{65}}\cos\alpha = \frac{9}{\sqrt{65}}\cdot\frac{\sqrt{65}}{9} = 1$

$\sin\alpha = \frac{1}{4}$, $\alpha \in$ II chorak

15. $\frac{16}{\sqrt{15}}\cos(\pi-\alpha) = -\frac{16}{\sqrt{15}}\cos\alpha = \frac{16}{\sqrt{15}}\cdot\frac{\sqrt{15}}{4} = 4$

16. $7{,}8\sin\left(\frac{3}{2}\pi-\alpha\right) =$ $\sin\alpha = \frac{12}{13}$, $\alpha \in$ II chorak.

$= -7{,}8\cos\alpha = -7{,}8\cdot\left(-\frac{5}{13}\right) = 3$

17. $\sin\alpha = -\frac{3}{5}$, $\alpha \in$ III ch.

$6{,}25\sin\left(\frac{\pi}{2}+\alpha\right) = 6{,}25\cos\alpha = -6{,}25\cdot\frac{4}{5} = -1{,}25\cdot 4 = -5$

18. $\sin\alpha = -\frac{\sqrt{7}}{4}$, $\alpha \in$ IV chorak.

$4\sin\left(\frac{3}{2}\pi+\alpha\right) = -4\cos\alpha = -4\cdot\frac{3}{4} = -3$

19. $\sin\alpha = -\frac{\sqrt{21}}{5}$, $\alpha \in$ III chorak

$15\sin\left(\frac{\pi}{2}+\alpha\right) = 15\cos\alpha = 15\cdot\left(-\frac{2}{5}\right) = -6.$

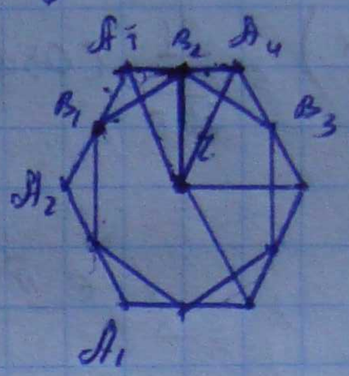
20. $\left(\frac{20}{3}\ \sin\alpha = -\frac{4}{}\right)$

Задача 11.

Задача 5

$S_6 = 64$

$S_6' - ?$



$\left(S = \frac{1}{2}\cdot P\cdot r = 64\right.$

$\left. = \frac{P\cdot r}{} = 128.\right)$

$S_6 = 6\cdot\frac{1}{2}\cdot a^2\cdot\frac{\sqrt{3}}{2} = \frac{3a^2}{2} = \frac{3\sqrt{3}a^2}{2} = 64$

$S_6' =$

$b^2 = 2\cdot\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2 = \frac{3a_6^2}{4} = \frac{3\cdot 2\cdot 64}{3\sqrt{3}\cdot 4} = \frac{2\cdot 16\sqrt{3}}{3}$

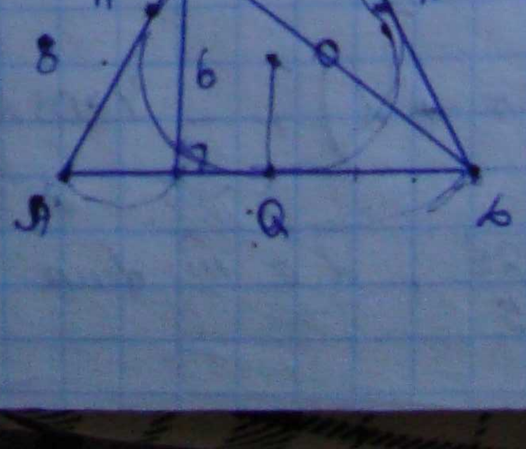
$S_6' = \frac{3\sqrt{3}}{2}b_6^2 = \frac{3\sqrt{3}\cdot 2\cdot 16\cdot\sqrt{3}}{2\cdot 3} = 3\cdot 16 = 48$

Задача 10.

$AB = CD.$

$P = 32$

$r = OQ = 3$



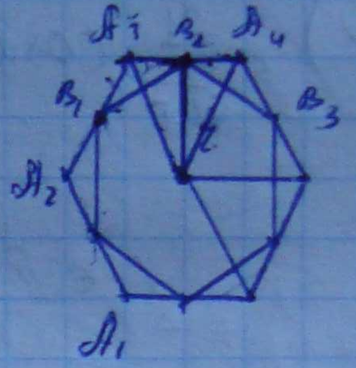
$64 - 36 = 28$

$15\sin\left(\frac{\pi}{2}+\alpha\right) = 15\cos\alpha = 15\cdot\left(-\frac{2}{5}\right) = -6$

20. $\left(\frac{20}{3}\right.$ $\sin\alpha = -\frac{4}{}\left.\right)$

Задача 11.

Задача 5



$S_6 = 64$

$S_6' - ?$

$\left(S = \frac{1}{2}\cdot P\cdot r = 64\right.$

$= \left.\frac{P\cdot r}{} = 128.\right)$

$S_6 = 6\cdot\frac{1}{2}\cdot a^2\cdot\frac{\sqrt{3}}{2} = \frac{3a^2}{2} = \frac{3\sqrt{3}a^2}{2} = 64$

$S_6' =$

$b^2 = 2\cdot\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2 = \frac{3a_6^2}{4} = \frac{3\cdot 2\cdot 64}{3\sqrt{3}\cdot 4} = \frac{2\cdot 16\sqrt{3}}{3}$

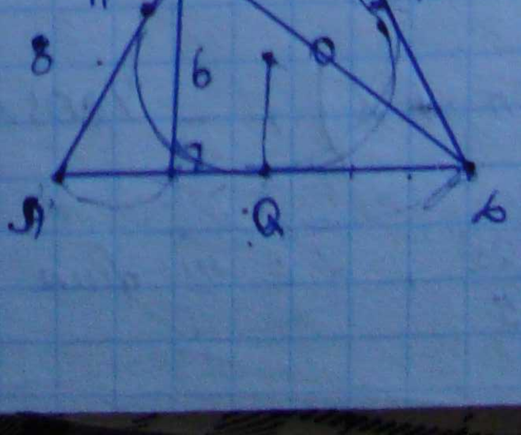
$S_6' = \frac{3\sqrt{3}}{2}b_6^2 = \frac{3\sqrt{3}\cdot 2\cdot 16\cdot\sqrt{3}}{2\cdot 3} = 3\cdot 16 = 48$

Задача 10

$AB = CD$

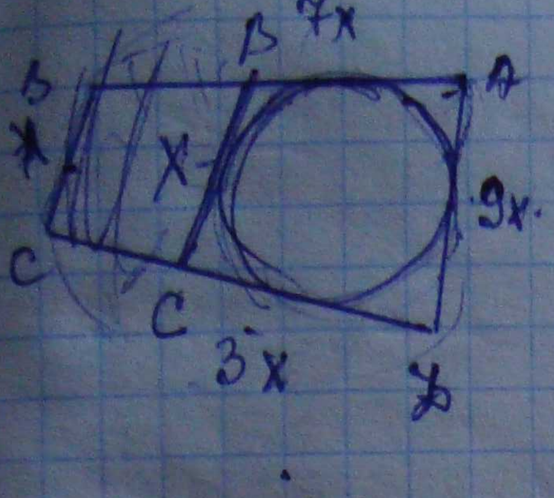
$P = 32$

$r = OQ = 3$

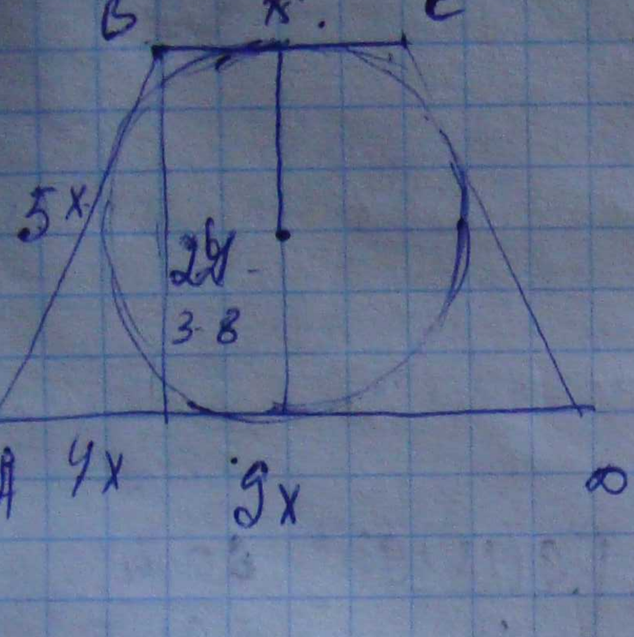


$64 - 36 = 28$

Задача 28



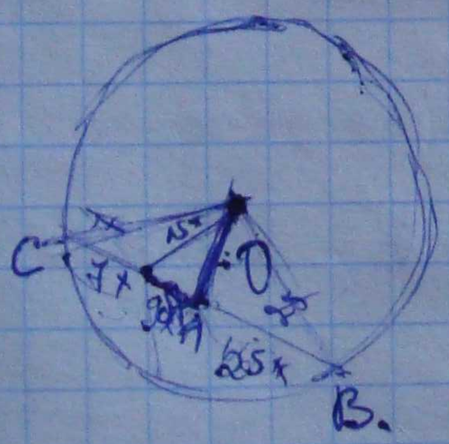
$\frac{AD}{CB} = 9$



Задача 35

$z = 12$

$5x = 40 = AB$



$25x + 7x = 32x$

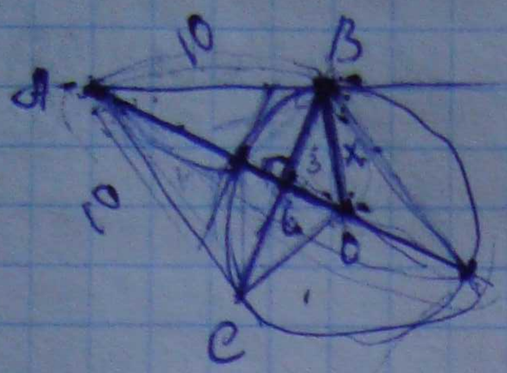
$CH = 16x$

$CA = 9x$

$225 =$

$32 \quad 16x$

9



$x \cdot 9 = 100$ $\quad CA^2 = \sqrt{1091}$

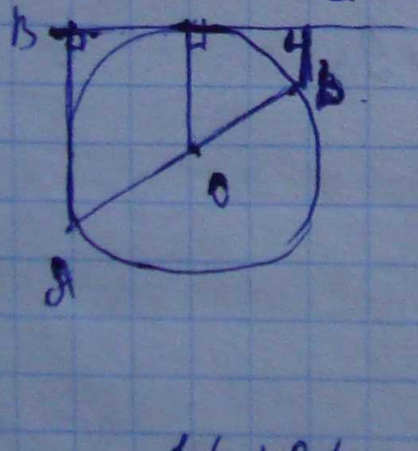
$CA^0 = \sqrt{109}$

$Ob \cdot \sqrt{91} = 9$

$Ob = \frac{9}{\sqrt{91}} = \frac{9\sqrt{91}}{91}$

$x = \sqrt{9 + \frac{81 \cdot 91}{91^2}} = \sqrt{\frac{9 \cdot 91 + 81}{91}} = \sqrt{\frac{9(91+9)}{91}} = \frac{BO\sqrt{91}}{91}$

Задача 47.

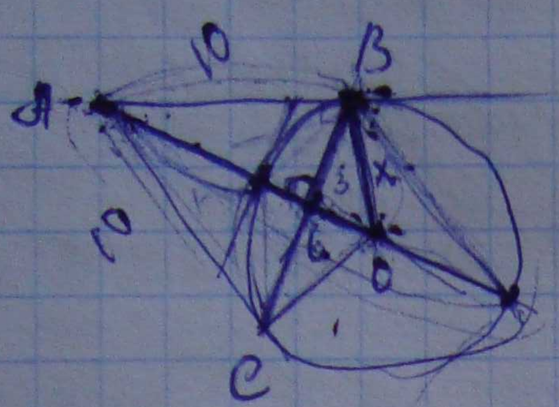


$AB = 1,6.$

$Cb = 0,6.$

$Ab - ?$

$\frac{1,6 + 0,6}{2} = 1,1.$



$X \cdot d = 100$ $\quad CA^2 = \sqrt{1091}$

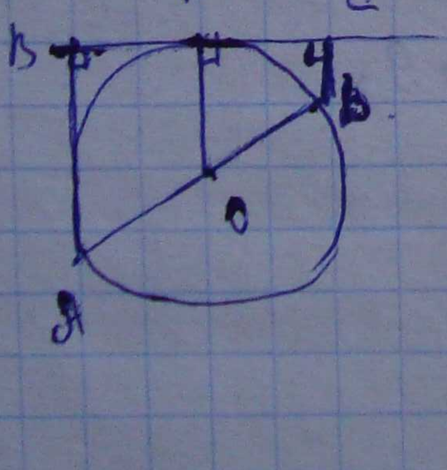
$CA^0 = \sqrt{109}$

$Ob \cdot \sqrt{91} = 9$

$Ob = \frac{9}{\sqrt{91}} = \frac{9\sqrt{91}}{91}$

$X = \sqrt{9 + \frac{81 \cdot 91}{91^2}} = \sqrt{\frac{9 \cdot 91 + 81}{91}} = \sqrt{\frac{9(91+9)}{91}} = \frac{BO\sqrt{91}}{91}$

Задача 47.



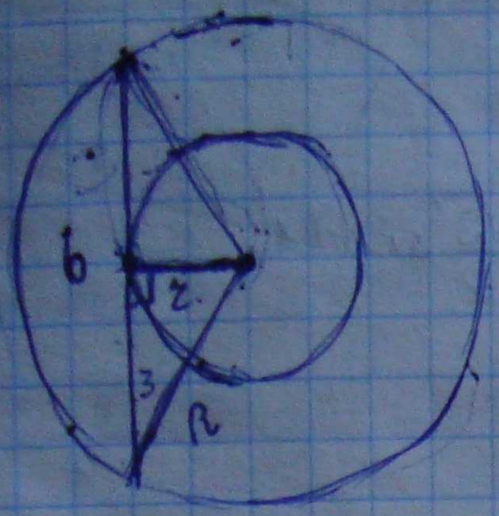
$AB = 1,6.$

$Cb = 0,6.$

$Ab - ?$

$\frac{1,6 + 0,6}{2} = 1,1.$

50



$R^2 = 9 + z^2$

$\pi(R^2 - z^2) = 9\pi$

Итого: из/интегралов ф. 11 п. 25-35; 46-49; 55-60.

$$\sin 3\left(x - \frac{\pi}{2}\right) + \cos 2\left(x + \frac{\pi}{4}\right) = 0$$

$$(-\cos 3x + \cos 2()$$

$$\sin\left(3x - \frac{3}{\cancel{0}}\pi\right) + \cos\left(2\left(2x + \frac{\pi}{2}\right)\right) = 0.$$

$$\cos 3x - \sin 2x = 0.$$

$$\cos 3x - \cos\left(\frac{\pi}{2} - 2x\right) = 0.$$

$$2\sin\left(\frac{\pi}{2} + x\right)\sin\left(5x - \frac{\pi}{2}\right) = 0$$

$$-2\cos x \cos 5x = 0$$

$$\left[\begin{array}{l}\cos x = 0 \\ \cos 5x = 0\end{array}\right. \Rightarrow \left[\begin{array}{l}x = \frac{\pi}{2} + \pi k \\ 5x = \frac{\pi}{2} + \pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x = \frac{\pi}{2} + \pi k \\ x = \frac{\pi}{10} + \frac{\pi}{5}k\end{array}\right.$$

$\cos 7x - \sin 5x = \sqrt{3}(\cos 5x - \sin 7x)$.

$\cos 7x - \sin 5x = \sqrt{3}\cos 5x - \sqrt{3}\sin 7x$.

$\cos 7x - \sqrt{3}\cos 5x = \sin 5x - \sqrt{3}\sin 7x$.

$\frac{1}{2}\cos 7x - \frac{\sqrt{3}}{2}\cos 5x = \frac{\sqrt{3}}{2}\sin 5x - \frac{\sqrt{3}}{2}\sin 7x$.

sin)

$\cos 7x + \sqrt{3}\sin 7x = \sqrt{3}\cos 5x + \sin 5x$

$\frac{1}{2}\cos 7x + \frac{\sqrt{3}}{2}\sin 7x = \frac{\sqrt{3}}{2}\cos 5x + \frac{1}{2}\sin 5x$

$\cos\frac{\pi}{3}\cos 7x + \cos\sin\frac{\pi}{3}\sin 7x = \cos\frac{\pi}{6}\cos 5x + \sin\frac{\pi}{6}\sin 5x$

$2\cos\left(\frac{\pi}{6} + \frac{7}{2}x\right)\cos\left(\frac{\pi}{6} - \frac{7}{2}x\right)$

$\cos\left(7x - \frac{\pi}{3}\right) = \cos\left(5x - \frac{\pi}{6}\right)$

$\cos\left(7x - \frac{\pi}{3}\right) - \cos\left(5x - \frac{\pi}{6}\right) = 0$

$2\sin$

$\sin 5x \cdot \cos 3x = \sin 9x \cos 7x$.

$\sin 5x\cos 3x - \sin 9x\cos 7x = 0$.

$\frac{1}{2}(\sin 8x + \sin 2x) - \frac{1}{2}(\sin 16x + \sin 2x) = 0$

$\sin 8x + \sin 2x - \sin 16x - \sin 2x = 0$

$-2\sin 4x\cos 12x = 0$

$$\left[\begin{array}{l}\sin 4x = 0 \\ \cos 12x = 0\end{array}\right. \Rightarrow \left[\begin{array}{l}4x = \frac{\pi}{2} \pm \pi + \pi k \\ 12x = \frac{\pi}{2} + \pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x = \frac{\pi}{4} k \\ x = \frac{\pi}{24} + \frac{\pi}{12} k.\end{array}\right.$$

$$\sin^2 x + \sin^2 2x + \sin^2 3x = 1{,}5.$$

$$\frac{1-\cos 2x}{2} + \frac{1-\cos 4x}{2} + \frac{1-\cos 6x}{2} = 1{,}5.$$

$$3 - (\cos 2x + \cos 4x + \cos 6x) = 3$$

$$\cos 2x + \cos 4x + \cos 6x = 0.$$

$$2\cos 6x \cos 2x + \cos 6x = 0.$$

$$\cos 6x (2\cos 2x + 1) = 0.$$

$$\left[\begin{array}{l}\cos 6x = 0 \\ \cos 2x = -\frac{1}{2}\end{array}\right. \Rightarrow \left[\begin{array}{l}6x = \frac{\pi}{2} + \pi k \\ 2x = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k\end{array}\right. \quad :3$$

$$\Rightarrow \left[\begin{array}{l}x = \frac{\pi}{12} + \frac{\pi}{6} k \\ x = \pm \frac{\pi}{3} + \pi k.\end{array}\right.$$

$$3\cos^2 x - \sin^2 x - \sin 2x = 0.$$

$$3(\cos^2 x + \sin^2 x) - \sin^2 x - \sin 2x = 0.$$

$$3\frac{(1+\cos 2x)}{2} - \frac{(1-\cos 2x)}{2} - \sin 2x = 0.$$

$$3 + 3\cos 2x - 1 + \cos 2x - 2\sin 2x = 0.$$

$0{,}5(\cos 6x + \cos 7x) - \cos^2 2x + \sin^2 3x = 0.$

$0{,}5(2\cos 6x \cos x) - \cos^2 2x + \sin^2 3x = 0.$

$\sin^2 3x + \cos 6x \cos x - \cos^2 2x = 0$

9 f, 9

$\sin^2 3x - 4\cos\left(\frac{\pi}{2} - 3x\right) = 0.$

$\sin^2 3x - 4\sin 3x = 0$

$\sin 3x(\sin 3x - 4) = 0.$

$\sin 3x = 0$

$3x = \pi k$

$x = \frac{\pi}{3} k, \quad k \in Z.$

$x = 0; \frac{\pi}{3}$

2. $2\sin x \cos x - \sqrt{3}(\cos^2 x - \sin^2 x) = 2\sin 5x.$

$(\sqrt{3}\sin^2 x + 2\sin x)$

$\sin 2x - \sqrt{3}\cos 2x = 2\sin 5x.$

$\frac{1}{2}\sin 2x - \frac{\sqrt{3}}{2}\cos 2x = \sin 5x.$

$\cos\frac{\pi}{6}\sin 2x - \sin\frac{\pi}{6}\cos 2x = \sin 5x$

$\sin\left(2x - \frac{\pi}{6}\right) = \sin 5x.$

$$\sin\left(2x-\frac{\pi}{6}\right)-\sin 5x=0$$

$$-2\sin\left(3x+\frac{\pi}{6}\right)\cos\left(3{,}5x-\frac{\pi}{6}\right)=0$$

$$\left[\begin{array}{l}\sin\left(3x+\frac{\pi}{6}\right)=0\\ \cos\left(3{,}5x-\frac{\pi}{6}\right)=0\end{array}\right.\Rightarrow\left[\begin{array}{l}3x+\frac{\pi}{6}=\pi k\\ 3{,}5x-\frac{\pi}{6}=\frac{\pi}{2}+\pi k\end{array}\right.$$

$$\Rightarrow\left[\begin{array}{l}x=-\frac{\pi}{18}+\frac{\pi}{3}k\\ x=\frac{2}{7}\cdot\frac{2\pi}{3}+\frac{2\pi}{7}k\end{array}\right.\Rightarrow\left[\begin{array}{l}x=-\frac{\pi}{18}+\frac{\pi}{3}k\\ x=\frac{4\pi}{21}+\frac{2\pi}{7}k;\ k\in\mathbb{Z}\end{array}\right.$$

[illegible]

[illegible]

05.04.06г

[illegible]

1. $5\cos x+12\sin x=13$ $\qquad 25+144=169=13^2$

$$\frac{5}{13}\cos x+\frac{12}{13}\sin x=1$$

$$\cos\left(\arccos\frac{5}{13}\right)\cos x+\sin\left(\arcsin\frac{12}{13}\right)\sin x=1$$

$$\cos\left(\arccos\frac{5}{13}-x\right)=1$$

$$\arccos\frac{5}{13}-x=2\pi k$$

$$x=\arccos\frac{5}{13}+2\pi k=\operatorname{arctg}\frac{12}{5}+2\pi k$$

$\sin\left(2x - \frac{\pi}{6}\right) - \sin 5x = 0$

$-2 \sin\left(3x + \frac{\pi}{6}\right) \cos\left(3{,}5x - \frac{\pi}{6}\right) = 0$

$$\left[\begin{array}{l} \sin\left(3x + \frac{\pi}{6}\right) = 0 \\ \cos\left(3{,}5x - \frac{\pi}{6}\right) = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 3x + \frac{\pi}{6} = \pi k \\ 3{,}5x - \frac{\pi}{6} = \frac{\pi}{2} + \pi k \end{array}\right.$$

$$\Rightarrow \left[\begin{array}{l} x = -\frac{\pi}{18} + \frac{\pi}{3} k \\ x = \frac{2}{7}\cdot\frac{2\pi}{3} + \frac{2}{7}\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = -\frac{\pi}{18} + \frac{\pi}{3} k \\ x = \frac{4\pi}{21} + \frac{2\pi}{7} k; k \in \mathbb{Z} \end{array}\right.$$

[illegible]

05.04.06г.

[illegible]

1. $5\cos x + 12 \sin x = 13$ $\qquad 25 + 144 = 169 = 13^2$

$\frac{5}{13}\cos x + \frac{12}{13}\sin x = 1$

$\cos\left(\arccos\frac{5}{13}\right)\cos x + \sin\left(\arcsin\frac{12}{13}\right)\sin x = 1$

$\cos\left(\arccos\frac{5}{13} - x\right) = 1$

$\arccos\frac{5}{13} - x = 2\pi k$

$x = \arccos\frac{5}{13} + 2\pi k = \operatorname{arctg}\frac{12}{5} + 2\pi k$

2. $3\sin x + 4\cos x = 2$

$$\frac{3}{5}\sin x + \frac{4}{5}\cos x = \frac{2}{5}$$

$$\sin\left(\arcsin\frac{3}{5}\right)\sin x + \cos\left(\arccos\frac{4}{5}\right)\cos x = \frac{2}{5}$$

$$\cos\left(\arccos\frac{4}{5} - x\right) = \frac{2}{5}$$

$$\cos\left(x - \arccos\frac{4}{5}\right) = \frac{2}{5}$$

$$x - \arccos\frac{4}{5} = \pm\arccos\frac{2}{5} + 2\pi k$$

$$x = \arccos\frac{4}{5} \pm \arccos\frac{2}{5} + 2\pi k$$

3. $5\sin x + 12\cos x = 13$

$$\sin\left(\arcsin\frac{5}{13}\right) + \cos\left(\arccos\frac{12}{13}\right)\cos x = 1$$

$$\cos\left(x - \arccos\frac{12}{13}\right) = 1$$

$$x - \arccos\frac{12}{13} = 2\pi k$$

$$x = \arccos\frac{12}{13} + 2\pi k$$

4. $\sin x - 2\cos x = 1$

$$\frac{1}{\sqrt{5}}\sin x - \frac{2}{\sqrt{5}}\cos x = \frac{1}{\sqrt{5}}$$

$$\sin\left(\arcsin\frac{1}{\sqrt{5}}\right)\sin x - \cos\left(\arccos\frac{2}{\sqrt{5}}\right)\cos x = \frac{1}{\sqrt{5}}$$

$$-\cos\left(x + \arccos\frac{2}{\sqrt{5}}\right) = \frac{1}{\sqrt{5}}$$

2. $3\sin x + 4\cos x = 2$

$$\frac{3}{5}\sin x + \frac{4}{5}\cos x = \frac{2}{5}$$

$$\sin\left(\arcsin\frac{3}{5}\right)\sin x + \cos\left(\arccos\frac{4}{5}\right)\cos x = \frac{2}{5}$$

$$\cos\left(\arccos\frac{4}{5} - x\right) = \frac{2}{5}$$

$$\cos\left(x - \arccos\frac{4}{5}\right) = \frac{2}{5}$$

$$x - \arccos\frac{4}{5} = \pm\arccos\frac{2}{5} + 2\pi k$$

$$x = \arccos\frac{4}{5} \pm \arccos\frac{2}{5} + 2\pi k$$

3. $5\sin x + 12\cos x = 13$

$$\sin\left(\arcsin\frac{5}{13}\right) + \cos\left(\arccos\frac{12}{13}\right)\cos x = 1$$

$$\cos\left(x - \arccos\frac{12}{13}\right) = 1$$

$$x - \arccos\frac{12}{13} = 2\pi k$$

$$x = \arccos\frac{12}{13} + 2\pi k$$

4. $\sin x - 2\cos x = 1$

$$\frac{1}{\sqrt{5}}\sin x - \frac{2}{\sqrt{5}}\cos x = \frac{1}{\sqrt{5}}$$

$$\sin\left(\arcsin\frac{1}{\sqrt{5}}\right)\sin x - \cos\left(\arccos\frac{2}{\sqrt{5}}\right)\cos x = \frac{1}{\sqrt{5}}$$

$$-\cos\left(x + \arccos\frac{2}{\sqrt{5}}\right) = \frac{1}{\sqrt{5}}$$

$$\cos\left(x+\arccos\frac{2}{\sqrt{5}}\right)=-\frac{1}{\sqrt{5}}$$

$$x+\arccos\frac{2}{\sqrt{5}}=\pm\left(\pi-\arccos\frac{1}{\sqrt{5}}\right)+2\pi k$$

$$x=-\arccos\frac{2}{\sqrt{5}}\pm\left(\pi-\arccos\frac{1}{\sqrt{5}}\right)+2\pi k$$

$$x_1=-\arccos\frac{2}{\sqrt{5}}-\pi+\arccos\frac{1}{\sqrt{5}}+2\pi k=$$

$$=-\arccos\frac{2}{\sqrt{5}}-\pi+\frac{\pi}{2}-\arccos\frac{2}{\sqrt{5}}+2\pi k=$$

$$=-2\arccos\frac{2}{\sqrt{5}}-\frac{\pi}{2}+2\pi k$$

$$x=-\arccos\frac{2}{\sqrt{5}}+\pi-\arccos\frac{1}{\sqrt{5}}+2\pi k=$$

$$=-\arccos\frac{2}{\sqrt{5}}+\pi-\left(\frac{\pi}{2}-\arccos\frac{2}{\sqrt{5}}\right)+2\pi k=$$

$$=-\arccos\frac{2}{\sqrt{5}}+\pi-\frac{\pi}{2}+\arccos\frac{2}{\sqrt{5}}+2\pi k=$$

$$=\frac{\pi}{2}+2\pi k$$

Ответ: $\frac{\pi}{2}+2\pi k;\ -2\arccos\frac{2}{\sqrt{5}}-\frac{\pi}{2}+2\pi k$.

5. $2\sin x+\cos x=2$

$$\frac{2}{\sqrt{5}}\sin x+\frac{1}{\sqrt{5}}\cos x=\frac{2}{\sqrt{5}}$$

$$\sin\left(\arcsin\frac{2}{\sqrt{5}}\right)\sin x+\cos\left(\arccos\frac{1}{\sqrt{5}}\right)\cos x=\sin\left(\arcsin\frac{2}{\sqrt{5}}\right)$$

$$\cos\left(x - \arccos\frac{1}{\sqrt{5}}\right) = \frac{2}{\sqrt{5}}$$

$$x - \arccos\frac{1}{\sqrt{5}} = \pm\arccos\frac{2}{\sqrt{5}} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} \pm \arccos\frac{2}{\sqrt{5}} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} - \left(\frac{\pi}{2} - \arccos\frac{1}{\sqrt{5}}\right) + 2\pi k =$$

$$= \arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + \arccos\frac{1}{\sqrt{5}} + 2\pi k =$$

$$= 2\arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} + \frac{\pi}{2} - \arccos\frac{1}{\sqrt{5}} + 2\pi k = \frac{\pi}{2} + 2\pi k$$

Ответ: $\frac{\pi}{2} + 2\pi k$; $2\arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + 2\pi k$

6. $3\sin 3x + 4\cos 3x = -5$

$$\frac{3}{5}\sin 3x + \frac{4}{5}\cos 3x = -1$$

$$\cos\left(\arccos\frac{4}{5}\right)\cos 3x + \sin\left(\arcsin\frac{3}{5}\right)\sin 3x = -1$$

$$\cos\left(3x - \arccos\frac{4}{5}\right) = -1.$$

$$3x - \arccos\frac{4}{5} = \pi + 2\pi k$$

$$x = \frac{\arccos\frac{4}{5}}{3} + \frac{\pi}{3} + \frac{2}{3}\pi k$$

$$\cos\left(x - \arccos\frac{1}{\sqrt{5}}\right) = \frac{2}{\sqrt{5}}$$

$$x - \arccos\frac{1}{\sqrt{5}} = \pm\arccos\frac{2}{\sqrt{5}} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} \pm \arccos\frac{2}{\sqrt{5}} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} - \left(\frac{\pi}{2} - \arccos\frac{1}{\sqrt{5}}\right) + 2\pi k =$$

$$= \arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + \arccos\frac{1}{\sqrt{5}} + 2\pi k =$$

$$= 2\arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + 2\pi k$$

$$x = \arccos\frac{1}{\sqrt{5}} + \frac{\pi}{2} - \arccos\frac{1}{\sqrt{5}} + 2\pi k = \frac{\pi}{2} + 2\pi k$$

Ответ: $\frac{\pi}{2} + 2\pi k$; $2\arccos\frac{1}{\sqrt{5}} - \frac{\pi}{2} + 2\pi k$

6. $3\sin 3x + 4\cos 3x = -5$

$$\frac{3}{5}\sin 3x + \frac{4}{5}\cos 3x = -1$$

$$\cos\left(\arccos\frac{4}{5}\right)\cos 3x + \sin\left(\arcsin\frac{3}{5}\right)\sin 3x = -1$$

$$\cos\left(3x - \arccos\frac{4}{5}\right) = -1.$$

$$3x - \arccos\frac{4}{5} = \pi + 2\pi k$$

$$x = \frac{\arccos\frac{4}{5}}{3} + \frac{\pi}{3} + \frac{2}{3}\pi k$$

7. $5\sin 2x - 12\cos 2x = 13$

$\sin\left(\arcsin\frac{5}{13}\right)\sin 2x - \cos\left(\arccos\frac{12}{13}\right)\cos 2x = 1$

$-\cos\left(2x - \arccos\frac{12}{13}\right) = 1$

$2x - \arccos\frac{12}{13} = \pm(\pi) + \pi + 2\pi k$

$x = \frac{1}{2}\arccos\frac{12}{13} + \frac{\pi}{2} + \pi k$

8. $\sqrt{3}\cos x + \sin x = \sqrt{2}$

$\frac{\sqrt{3}}{2}\cos x + \frac{1}{2}\sin x = \frac{\sqrt{2}}{2}$

$\cos\left(x - \frac{\pi}{6}\right) = \frac{\sqrt{2}}{2}$

$x - \frac{\pi}{6} = \pm\frac{\pi}{4} + 2\pi k$

$x = \frac{\pi}{6} \pm \frac{\pi}{4} + 2\pi k$

$x = \frac{\pi}{6} - \frac{\pi}{4} + 2\pi k = -\frac{\pi}{12} + 2\pi k$

$x = \frac{\pi}{6} + \frac{\pi}{4} + 2\pi k = \frac{5}{12}\pi + 2\pi k$

9. $\cos x - \sqrt{3}\sin x = -1.$

$\frac{1}{2}\cos x - \frac{\sqrt{3}}{2}\sin x = -\frac{1}{2}$

$\cos\left(x + \frac{\pi}{3}\right) = -\frac{1}{2}$

$$x + \frac{\pi}{3} = \pm\left(\pi - \cancel{\arccos}\frac{\pi}{3}\right) + 2\pi k =$$

$$x = -\frac{\pi}{3} \pm \left(\pi - \cancel{\arccos}\frac{\pi}{3}\right) + 2\pi k = -\frac{\pi}{3} \pm \frac{2\pi}{3} + 2\pi k$$

$$\left(x = -\frac{\pi}{3} - \pi + 1\right)$$

$$x = -\frac{\pi}{3} - \frac{2}{3}\pi + 2\pi k = -\pi + 2\pi k = \pi + 2\pi k$$

$$x = -\frac{\pi}{3} + \frac{2\pi}{3} + 2\pi k = \frac{\pi}{3} + 2\pi k$$

10. $\sqrt{3}\cos x + \sin(\pi + x) = \sqrt{2}$

$$\sqrt{3}\cos x - \sin x = \sqrt{2}$$

$$\frac{\sqrt{3}}{2}\cos x - \frac{1}{2}\sin x = \frac{\sqrt{2}}{2}$$

$$\cos\frac{\pi}{6}\cos x - \sin\frac{\pi}{6}\sin x = \frac{\sqrt{2}}{2}$$

$$\cos\left(\frac{\pi}{6} + x\right) = \frac{\sqrt{2}}{2}$$

$$\frac{\pi}{6} + x = \pm\frac{\pi}{4} + 2\pi k$$

$$x = -\frac{\pi}{6} \pm \frac{\pi}{4} + 2\pi k$$

$$x = -\frac{\pi}{6} - \frac{\pi}{4} + 2\pi k = -\frac{5}{12}\pi + 2\pi k$$

$$x = -\frac{\pi}{6} + \frac{\pi}{4} + 2\pi k = \frac{\pi}{12} + 2\pi k$$

$$x + \frac{\pi}{3} = \pm\left(\pi - \cancel{\arccos}\frac{\pi}{3}\right) + 2\pi k =$$

$$x = -\frac{\pi}{3} \pm \left(\pi - \cancel{\arccos}\frac{\pi}{3}\right) + 2\pi k = -\frac{\pi}{3} \pm \frac{2\pi}{3} + 2\pi k$$

$$\left(x = -\frac{\pi}{3} - \pi + 1\right)$$

$$x = -\frac{\pi}{3} - \frac{2}{3}\pi + 2\pi k = -\pi + 2\pi k = \pi + 2\pi k$$

$$x = -\frac{\pi}{3} + \frac{2\pi}{3} + 2\pi k = \frac{\pi}{3} + 2\pi k$$

10. $\sqrt{3}\cos x + \sin(\pi + x) = \sqrt{2}$

$$\sqrt{3}\cos x - \sin x = \sqrt{2}$$

$$\frac{\sqrt{3}}{2}\cos x - \frac{1}{2}\sin x = \frac{\sqrt{2}}{2}$$

$$\cos\frac{\pi}{6}\cos x - \sin\frac{\pi}{6}\sin x = \frac{\sqrt{2}}{2}$$

$$\cos\left(\frac{\pi}{6} + x\right) = \frac{\sqrt{2}}{2}$$

$$\frac{\pi}{6} + x = \pm\frac{\pi}{4} + 2\pi k$$

$$x = -\frac{\pi}{6} \pm \frac{\pi}{4} + 2\pi k$$

$$x = -\frac{\pi}{6} - \frac{\pi}{4} + 2\pi k = -\frac{5}{12}\pi + 2\pi k$$

$$x = -\frac{\pi}{6} + \frac{\pi}{4} + 2\pi k = \frac{\pi}{12} + 2\pi k$$

11. $\sqrt{3}\cos(\pi - x) + \sin x = \sqrt{2}$

$\sin x - \sqrt{3}\cos x = \sqrt{2}$

$\frac{1}{2}\sin x - \frac{\sqrt{3}}{2}\cos x = \frac{\sqrt{2}}{2}$

$\sin\frac{\pi}{6}\sin x - \cos\left(\frac{\pi}{6} + x\right) = \frac{\sqrt{2}}{2}$

$\frac{\pi}{6} + x = \pm\left(\pi - \frac{\pi}{4}\right) + 2\pi k$

$x = -\frac{\pi}{6} \pm \frac{3\pi}{4} + 2\pi k =$

$x = -\frac{\pi}{6} - \frac{3\pi}{4} + 2\pi k = -\frac{11}{12}\pi + 2\pi k$

$x = -\frac{\pi}{6} + \frac{3\pi}{4} + 2\pi k = \frac{7\pi}{12} + 2\pi k$

12. $\cos^2 x - 3\sin x\cos x = -1$

$\cos^2 x - 3\sin x\cos x + \sin^2 x + \cos^2 x = 0$

(2 co) $\sin^2 x - 3\sin x\cos x + 2\cos^2 x = 0$ $\quad\cos x \neq 0$

$tg^2 x - 3tg x + 2 = 0$

$D = 9 - 8 = 1$

$tg x_{1,2} = \frac{3 \pm 1}{2}$ $\begin{matrix}1\\2\end{matrix}$

$$\begin{cases} tg x = 1 \\ tg x = 2 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{4} + \pi k, \; k \in Z \\ x = \operatorname{arctg} 2 + \pi k, \; k \in Z \end{cases}$$

Ответ: $\frac{\pi}{4} + \pi k$; $\operatorname{arctg} 2 + \pi k$

13. $\cos 7x \cos 13x = \cos x \cos 19x$

$$\frac{1}{2}(\cos 20x + \cos 6x) = \frac{1}{2}(\cos 20x + \cos 18x)$$

$$\cos 20x + \cos 6x - \cos 20x - \cos 18x = 0$$

$$\cos 6x - \cos 18x = 0$$

$$-2 \sin 12x \sin 6x = 0$$

$$\sin 12x = 0$$

$$12x = \pi k$$

$$x = \frac{\pi}{12} k$$

14. $\sin 11x \cos 6x = \sin 9x \cos 4x$

$$\frac{1}{2}(\sin 17x + \sin 5x) = \frac{1}{2}(\sin 13x + \sin 5x)$$

$$\sin 17x + \sin 5x = \sin 13x - \sin 5x = 0$$

$$\sin 17x - \sin 13x = 0$$

$$2 \cos 15x \sin 2x = 0$$

$$\left[\begin{array}{l} \cos 15x = 0 \\ \sin 2x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 15x = \frac{\pi}{2} + \pi k \\ 2x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{30} + \frac{\pi}{15} k \\ x = \frac{\pi}{4} + \frac{\pi}{2} k \end{array}\right.$$

$k \in Z$

13. $\cos 7x \cos 13x = \cos x \cos 19x$

$$\frac{1}{2}(\cos 20x + \cos 6x) = \frac{1}{2}(\cos 20x + \cos 18x)$$

$$\cos 20x + \cos 6x - \cos 20x - \cos 18x = 0$$

$$\cos 6x - \cos 18x = 0$$

$$-2 \sin 12x \sin 6x = 0$$

$$\sin 12x = 0$$

$$12x = \pi k$$

$$x = \frac{\pi}{12} k$$

14. $\sin 11x \cos 6x = \sin 9x \cos 4x$

$$\frac{1}{2}(\sin 17x + \sin 5x) = \frac{1}{2}(\sin 13x + \sin 5x)$$

$$\sin 17x + \sin 5x = \sin 13x - \sin 5x = 0$$

$$\sin 17x - \sin 13x = 0$$

$$2 \cos 15x \sin 2x = 0$$

$$\left[\begin{array}{l} \cos 15x = 0 \\ \sin 2x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 15x = \frac{\pi}{2} + \pi k \\ 2x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{30} + \frac{\pi}{15} k \\ x = \frac{\pi}{4} + \frac{\pi}{2} k \end{array}\right.$$

$k \in Z$

15. $\sin x \sin 6x = \sin 8x \sin 3x$

$+\frac{1}{2}(\sin \frac{1}{2}(\cos 5x - \cos 7x) = \frac{1}{2}(\cos 5x - \cos 11x)$

$\cos 11x - \cos 7x = 0$

$\frac{1}{2} \sin 9x \sin 2x = 0$

$$\left[\begin{array}{l} \sin 9x = 0 \\ \sin 2x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 9x = \pi k \\ 2x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{9} k \;;\; k \Rightarrow z \\ x = \frac{\pi}{2} k \;;\; k \in z \end{array}\right.$$

16. $\cos 3x \cos 7x = \cos 4x \cos 6x$

$\frac{1}{2}(\cos 8x + \cos 2x) = \frac{1}{2}(\cos 10x + \cos 2x)$

$\cos 10x - \cos 8x = 0$

$2 \sin 9x \sin x = 0$

$$\left[\begin{array}{l} \sin 9x = 0 \\ \sin x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 9x = \pi k \\ x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{9} k \\ x = \pi k \end{array}\right.$$

17. $\sin x \sin 3x = \sin 5x \sin 7x$.

$\frac{1}{2}(\cos 2x - \cos 4x) = \frac{1}{2}(\cos 2x - \cos 12x)$

$\cos 12x - \cos 4x = 0$.

$2 \sin 8x \sin 4x = 0$.

$\sin 8x = 0$. $\quad 8x = \pi k$

$x = \frac{\pi}{8} k$.

18. $\sin 2x \cos 4x = \sin 6x \cos 8x.$

$$\frac{1}{2}(\sin 6x + \sin 2x) = \frac{1}{2}(\sin 14x + \sin 2x)$$

$$\sin 14x - \sin 6x = 0$$

$$2\cos 10x \sin 4x = 0.$$

$$\left[\begin{array}{l} \cos 10x = 0 \\ \sin 4x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{20} + \frac{\pi}{10}k \\ x = \frac{\pi}{4}k \end{array}\right.$$

19. $\sin 5x \cos 3x = \sin 9x \cos 7x$

$$\frac{1}{2}(\sin 8x + \sin 2x) = \frac{1}{2}(\sin 16x + \sin 2x)$$

$$\sin 16x - \sin 8x = 0$$

$$2\cos 12x \sin 4x = 0$$

$$\left[\begin{array}{l} \cos 12x = 0 \\ \sin 4x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{24} + \frac{\pi}{12}k \\ x = \frac{\pi}{4}k \end{array}\right.$$

20. $\cos 3x \cos 5x = \cos x \cos 7x$

$$\frac{1}{2}(\cos 8x + \cos 2x) = \frac{1}{2}(\cos 8x + \cos 6x)$$

$$\cos 6x - \cos 2x = 0$$

$$2\sin 4x \sin 2x = 0$$

$$\sin 4x = 0$$

$$x = \frac{\pi}{4}k; \quad k \in z$$

Ответ: $x = \frac{\pi}{4}k$

18. $\sin 2x \cos 4x = \sin 6x \cos 8x.$

$$\frac{1}{2}(\sin 6x + \sin 2x) = \frac{1}{2}(\sin 14x - \sin 2x)$$

$$\sin 14x - \sin 6x = 0$$

$$2\cos 10x \sin 4x = 0.$$

$$\left[\begin{array}{l} \cos 10x = 0 \\ \sin 4x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{20} + \frac{\pi}{10}k \\ x = \frac{\pi}{4}k \end{array}\right.$$

19. $\sin 5x \cos 3x = \sin 9x \cos 7x$

$$\frac{1}{2}(\sin 8x + \sin 2x) = \frac{1}{2}(\sin 16x + \sin 2x)$$

$$\sin 16x - \sin 8x = 0$$

$$2\cos 12x \sin 4x = 0$$

$$\left[\begin{array}{l} \cos 12x = 0 \\ \sin 4x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{24} + \frac{\pi}{12}k \\ x = \frac{\pi}{4}k \end{array}\right.$$

20. $\cos 3x \cos 5x = \cos x \cos 7x$

$$\frac{1}{2}(\cos 8x + \cos 2x) = \frac{1}{2}(\cos 8x + \cos 6x)$$

$$\cos 6x - \cos 2x = 0$$

$$2\sin 4x \sin 2x = 0$$

$$\sin 4x = 0$$

$$x = \frac{\pi}{4}k; \quad k \in Z$$

Ответ: $x = \frac{\pi}{4}k$

21. $\sin 2x \sin 4x = \sin x \sin 5x$

$$\frac{1}{2}(\cos 2x - \cos 6x) = \frac{1}{2}(\cos 4x - \cos 6x)$$

$$\cos 4x - \cos 2x = 0$$

$$-2 \sin 3x \sin x = 0$$

$$\left[\begin{array}{l} \sin 3x = 0 \\ \sin x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 3x = \pi k \\ x = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{3} k \\ x = \pi k \end{array}\right.$$

22. $\sin x \cos 5x = \sin 2x \cos 4x$

$$\frac{1}{2}(\sin 6x + \sin 4x) = \frac{1}{2}(\sin 6x - \sin 2x)$$

$$\sin 4x - \sin 2x = 0$$

$$2 \cos 3x \sin x = 0$$

$$\left[\begin{array}{l} \cos 3x = 0 \\ \sin x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{ll} x = \frac{\pi}{6} + \frac{\pi}{3} k & k \in Z \\ x = \pi k & k \in Z \end{array}\right.$$

28. $\cos 5x + \cos 7x = \cos(\pi + 6x)$

$$\cos 5x + \cos 7x + \cos 6x = 0$$

$$2 \cos 6x \cos x + \cos 6x = 0$$

$$\cos 6x (2 \cos x + 1) = 0$$

$$\left[\begin{array}{l} \cos 6x = 0 \\ \cos x = -\frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{12} + \frac{\pi}{6} k \; ; k \in Z \\ x = \pm \frac{2\pi}{3} + 2\pi k \; ; k \in Z \end{array}\right.$$

24. $\sin 3x + \sin 5x = \sin 4x$

$\sin 3x + \sin 5x - \sin 4x = 0$

$2 \sin 4x \cos x - \sin 4x = 0$

$\sin 4x (2\cos x - 1) = 0$

$$\left[\begin{array}{l} \sin 4x = 0 \\ \cos x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{4} k; \; k \in Z \\ x = \pm \frac{\pi}{3} + 2\pi k; \; k \in Z \end{array}\right.$$

25. $\sin 3x \sin 4x - \cos x = 0$

$\frac{1}{2}(\cos x - \cos 7x) - \cos x = 0$

$\cos x - \cos 7x - 2\cos x = 0$

$\cos 7x + \cos x = 0$

$2 \cos 4x \cos 3x = 0$

$$\left[\begin{array}{l} \cos 4x = 0 \\ \cos 3x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{8} + \frac{\pi}{4} k; \; k \in Z \\ x = \frac{\pi}{6} + \frac{\pi}{3} k; \; k \in Z \end{array}\right.$$

26. $1 + \cos x - \cos 2x = \cos 3x$

$\cos 3x + \cos 2x - \cos x = 1$

$2 \sin 2x \sin x + \cos 2x = 1$

$2 \sin 2x \sin x - 2 \sin^2 x = 0$

$\sin x (\sin ? \; 2 \sin^2 x \cos x - 2 \sin^2 x = 0$

$2\sin^2 x(\cos x - 1) = 0$

$$\left[\begin{array}{l}\sin^2 x = \sin x = 0\\ \cos x = 1\end{array}\right. \Rightarrow \left[\begin{array}{l}x = \pi k;\ k\in Z\\ x = 2\pi k;\ k\in Z.\end{array}\right. \Rightarrow x = \pi k;\ k\in Z$$

Ответ: $x = \pi k;\ k\in Z.$

27. $\cos 2x - \sqrt{3}\sin 2x = 2\cos 4x$

$(2(2\cos^2 2x - 1) - \cos 2x + \sqrt{3}\sin 2x = 0)$

$(4\cos^2 2x - \cos 2x + \sqrt{3}\sin 2x - 2 = 0)$

$(\cos 2x(4\cos 2x - 1) + \sqrt{3}\sin 2x - 2 = 0)$

$\cos\left(\frac{\pi}{3} + 2x\right) = \cos 4x.$

$\cos\left(\frac{\pi}{3} + 2x\right) - \cos 4x = 0$

$2\sin\left(\frac{\pi}{6} + 3x\right)\sin\left(\frac{\pi}{6} - x\right) = 0$

$$\left[\begin{array}{l}\sin\left(\frac{\pi}{6} + 3x\right) = 0\\ \sin\left(\frac{\pi}{6} - x\right) = 0\end{array}\right. \Rightarrow \left[\begin{array}{ll}\frac{\pi}{6} + 3x = \pi k & 3x + \frac{\pi}{6} = \pi k\\ \frac{\pi}{6} - x = \pi l & x - \frac{\pi}{6} = \pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x = -\frac{\pi}{18} + \frac{\pi}{3}k\\ x = \frac{\pi}{6} + \pi k\end{array}\right.$$

28. $\sqrt{3}\cos x + \sin x = 2\cos 3x$

$\cos\left(x - \frac{\pi}{6}\right) = \cos 3x$

$\cos\left(x - \frac{\pi}{6}\right) - \cos 3x = 0$

$-2\sin\left(2x - \frac{\pi}{12}\right)\sin\left(x + \frac{\pi}{12}\right) = 0$

$$\left[\begin{array}{l}\sin\left(2x-\frac{\pi}{12}\right)=0\\ \sin\left(x+\frac{\pi}{12}\right)=0\end{array}\right. \Rightarrow \left[\begin{array}{l}2x-\frac{\pi}{12}=\pi k\\ x+\frac{\pi}{12}=\pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x=\frac{\pi}{24}+\frac{\pi}{2}k\\ x=-\frac{\pi}{12}+\pi k\end{array}\right.$$

29. $\cos x + \sin x = \sqrt{2}\sin 3x$

$\left(\cos\left(x-\frac{\pi}{4}\right)=\sin 3x\right)$

$\sin\left(x+\frac{\pi}{4}\right)=\sin 3x$

$\sin\left(x+\frac{\pi}{4}\right)-\sin 3x=0$

$-2\cos\left(2x+\frac{\pi}{8}\right)\sin\left(x-\frac{\pi}{8}\right)=0.$

$$\left[\begin{array}{l}\cos\left(2x+\frac{\pi}{8}\right)=0\\ \sin\left(x-\frac{\pi}{8}\right)=0\end{array}\right. \Rightarrow \left[\begin{array}{l}2x+\frac{\pi}{8}=\frac{\pi}{2}+\pi k\\ x-\frac{\pi}{8}=\pi k\end{array}\right. \Rightarrow$$

$$\Rightarrow \left[\begin{array}{l}x=\frac{3\pi}{16}+\frac{\pi}{2}k;\ k\in Z\\ x=\frac{\pi}{8}+\pi k;\ k\in Z\end{array}\right.$$

30) $1+\cos x+\cos 2x+\cos 3x=0$

$(\cos x+\cos 3x)+\cos 2x+1=0$

$2\cos 2x\cos x+\cos 2x+1=0$

$\cos 2x(2\cos x+1)$

$2\cos 2x\cos x+2\cos^2 x=0$

$2\cos x(\cos 2x+\cos x)=0$

$$\begin{bmatrix} \sin\left(2x-\frac{\pi}{12}\right)=0 \\ \sin\left(x+\frac{\pi}{12}\right)=0 \end{bmatrix} \Rightarrow \begin{bmatrix} 2x-\frac{\pi}{12}=\pi k \\ x+\frac{\pi}{12}=\pi k \end{bmatrix} \Rightarrow \begin{bmatrix} x=\frac{\pi}{24}+\frac{\pi}{2}k \\ x=-\frac{\pi}{12}+\pi k \end{bmatrix}$$

29. $\cos x + \sin x = \sqrt{2}\sin 3x$

$\left(\cos\left(x-\frac{\pi}{4}\right)=\sin 3x\right)$

$\sin\left(x+\frac{\pi}{4}\right)=\sin 3x$

$\sin\left(x+\frac{\pi}{4}\right)-\sin 3x=0$

$-2\cos\left(2x+\frac{\pi}{8}\right)\sin\left(x-\frac{\pi}{8}\right)=0.$

$$\begin{bmatrix} \cos\left(2x+\frac{\pi}{8}\right)=0 \\ \sin\left(x-\frac{\pi}{8}\right)=0 \end{bmatrix} \Rightarrow \begin{bmatrix} 2x+\frac{\pi}{8}=\frac{\pi}{2}+\pi k \\ x-\frac{\pi}{8}=\pi k \end{bmatrix} \Rightarrow$$

$$\Rightarrow \begin{bmatrix} x=\frac{3\pi}{16}+\frac{\pi}{2}k;\ k\in Z \\ x=\frac{\pi}{8}+\pi k;\ k\in Z \end{bmatrix}$$

30) $1+\cos x+\cos 2x+\cos 3x=0$

$(\cos x+\cos 3x)+\cos 2x+1=0$

$2\cos 2x\cos x+\cos 2x+1=0$

~~$\cos 2x(2\cos x+1)$~~

$2\cos 2x\cos x+2\cos^2 x=0$

$2\cos x(\cos 2x+\cos x)=0$

$$\begin{cases} \cos x = 0 \\ \cos 2x + \cos x = 0 \qquad 2\cos\frac{3}{2}x\cos\frac{1}{2}x = 0 \\ (2\cos^2 x + \cos x - \cos^2 x - \sin^2 x = 0) \end{cases}$$

$$(\cos^2 x + \cos x - \sin^2 x = 0)$$

31. $\cos 2x - \cos 8x + \cos 6x = 1$

$$2\cos 4x\cos 2x - \cos 8x - 1 = 0$$

$$2\cos 4x \cdot \cos 2x - (2\cos^2 4x - 1) - 1 = 0$$

$$2\cos 4x\cos 2x - 2\cos^2 4x = 0$$

$$2\cos 4x(\cos 2x - \cos 4x) = 0$$

$$-2\cos 4x \cdot 2\sin 3x \sin x = 0$$

$$-4\cos 4x \sin 3x \sin x = 0$$

$$\begin{bmatrix} \cos 4x = 0 \\ \sin 3x = 0 \\ \sin x = 0 \end{bmatrix} \Rightarrow \begin{bmatrix} 4x = \frac{\pi}{2} + \pi k \Rightarrow x = \frac{\pi}{8} + \frac{\pi}{4}k \\ \left.\begin{matrix} 3x = \pi k \\ x = \pi k \end{matrix}\right\} \Rightarrow x = \frac{\pi}{3}k \end{bmatrix} \Rightarrow \begin{bmatrix} x = \frac{\pi}{8} + \frac{\pi}{4}k;\ k\in \\ x = \frac{\pi}{3}k;\ k\in \end{bmatrix}$$

32. $4\cos^2 x - 7\sin 2x = 2$

$$4\cos^2 x - 7\sin x\cos x - 2\sin^2 x - 2\cos^2 x = 0$$

$$2\sin^2 x + 7\sin x\cos x - 2\cos^2 x = 0 \qquad \cos x \neq 0$$

$$2\operatorname{tg}^2 x + 7\operatorname{tg} x - 2 = 0$$

$$D = 49 + 16 =$$

333. $2\sin^2 x - \sin x = 0$

$\sin x(2\sin x - 1) = 0$

$$\left[\begin{array}{l} \sin x = 0 \\ \sin x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = (-1)^k \frac{\pi}{6} + \pi k;\ k \in Z \end{array}\right.$$

б) $\sqrt{3}\sin x - \sin 2x = 0$

$\sin x(\sqrt{3} - 2\cos x) = 0$

$$\left[\begin{array}{l} \sin x = 0 \\ \cos x = \frac{\sqrt{3}}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = \pm \frac{\pi}{6} + 2\pi k;\ k \in Z \end{array}\right.$$

г) $tg^2 x - tg x = 0$

$tg x(tg x - 1) = 0$

$$\left[\begin{array}{l} tg x = 0 \\ tg x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = \frac{\pi}{4} + \pi k;\ k \in Z \end{array}\right.$$

д) $5\cos x = \sin 2x$

$\cos x(5 - 2\sin x) = 0$

$$\left[\begin{array}{l} \cos x = 0 \\ \sin x = 2{,}5 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k;\ k \in Z \\ x = (-1)^k \cdot \varnothing \end{array}\right.$$

е)

333. $2\sin^2 x - \sin x = 0$

$\sin x(2\sin x - 1) = 0$

$$\left[\begin{array}{l} \sin x = 0 \\ \sin x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = (-1)^k \frac{\pi}{6} + \pi k;\ k \in Z \end{array}\right.$$

б) $\sqrt{3}\sin x - \sin 2x = 0$

$\sin x(\sqrt{3} - 2\cos x) = 0$

$$\left[\begin{array}{l} \sin x = 0 \\ \cos x = \frac{\sqrt{3}}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = \pm \frac{\pi}{6} + 2\pi k;\ k \in Z \end{array}\right.$$

в) $tg^2 x - tg x = 0$

$tg x(tg x - 1) = 0$

$$\left[\begin{array}{l} tg x = 0 \\ tg x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = \frac{\pi}{4} + \pi k;\ k \in Z \end{array}\right.$$

г) $5\cos x = 3\sin 2x$

$\cos x(5 - 2\sin x) = 0$

$$\left[\begin{array}{l} \cos x = 0 \\ 3\sin x = 2{,}5 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k;\ k \in Z \\ \cancel{x = (-1)^k\ x \in \varnothing} \end{array}\right.$$

д)

334. а) $2\sin x + \operatorname{tg}(\pi - x) = 0$

$2\sin x - \operatorname{tg} x = 0$

$2\operatorname{tg} x \cos x - \operatorname{tg} x = 0$

$\operatorname{tg} x (2\cos x - 1) = 0$

$$\left[\begin{array}{l} \operatorname{tg} x = 0 \\ \cos x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k;\ k \in Z \\ x = \pm \frac{\pi}{3} + 2\pi k;\ k \in Z \end{array}\right.$$

б) $\operatorname{ctg}\frac{x}{2} + \cos(\pi - x) = 1$

$$\operatorname{ctg}\frac{x}{2} - \cos x - 1 = \frac{1 + \cos x - \cos x \sin x - \sin x}{\sin x} = \frac{\cos x(1 - \sin x) + 1 - \sin x}{\sin x} =$$

$$= \frac{(\cos x + 1)(1 - \sin x)}{\sin x} = \operatorname{ctg}\frac{x}{2}(1 - \sin x) = 0$$

$\operatorname{ctg}\frac{x}{2} - \cos x - 1 = 0$

$\left(\operatorname{ctg}\frac{x}{2} - 2\operatorname{ctg}^2\frac{x}{2}\sin^2\frac{x}{2} - \sin^2\frac{x}{2} - \cos^2\frac{x}{2} =\right.$

$= \operatorname{ctg}^2\frac{x}{2}\left(1 - 2\sin^2\frac{x}{2}\right) - 1 \Big) =$

$= \left(\operatorname{ctg}^2\frac{x}{2}\right)$

$\operatorname{ctg}\frac{x}{2} - \cos x - 1 = \operatorname{ctg}\frac{x}{2} - (1 + \cos x) = \operatorname{ctg}\frac{x}{2} - 2\cos^2\frac{x}{2} =$

$= \operatorname{ctg}\frac{x}{2} - 2\operatorname{ctg}^2\frac{x}{2}\sin^2\frac{x}{2} = \operatorname{ctg}\frac{x}{2}\left(1 - 2\cos\frac{x}{2}\sin\frac{x}{2}\right) =$

$= \operatorname{ctg}\frac{x}{2}(1 - \sin x) \Rightarrow \left[\begin{array}{l} \operatorname{ctg}\frac{x}{2} = 0 \\ \sin x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k \\ x = \frac{\pi}{2} + 2\pi k \end{array}\right. \Rightarrow x = \frac{\pi}{2} + \pi k$

а) $\sqrt{2}\sin\left(x+\frac{\pi}{2}\right)=\operatorname{ctg}(x+\pi)$

$\operatorname{ctg}x-\sqrt{2}\cos x=\frac{\cos x-\sqrt{2}\sin x\cos x}{\sin x}$, $\operatorname{tg}x\,(3-\sqrt{2}\sin x)=0$

$$\left[\begin{array}{l}\operatorname{tg}x=0\\ \sin x=\frac{\sqrt{2}}{2}\end{array}\right.\Rightarrow\left[\begin{array}{l}x=\pi k;\ k\in Z\\ x=(-1)^k\frac{\pi}{4}+\pi k;\ k\in Z\end{array}\right.$$

д) $2\sin x\cos x+4\cos x=3\sin x+2$

$(\cos x-1)(2\cos x(\sin x+2)-(3\sin x+2)=0$

$(2\cos x-1)(3\sin x+2)=0$

$$\left[\begin{array}{l}\cos x=\frac{1}{2}\\ 3\sin x=-2\end{array}\right.\Rightarrow\left[\begin{array}{l}x=\pm\frac{\pi}{3}+2\pi k;\ k\in Z\\ x\in\varnothing\ (\sin x<-1)\end{array}\right.$$

е) 335. ш) $\sin x+\cos x=0$ $\quad\cos x\neq 0$

$\operatorname{tg}x+1=0$

$\operatorname{tg}x=-1\Rightarrow x=-\frac{\pi}{4}+\pi k;\ k\in Z$

ф) $\sqrt{3}\cos x-\sin x=0$ $\quad\cos x\neq 0$

$\operatorname{tg}x-\sqrt{3}=0$

$\operatorname{tg}x=\sqrt{3}$

$x=\frac{\pi}{3}+\pi k;\ k\in Z$

а) $\sqrt{2}\sin\left(x+\frac{\pi}{2}\right)=\operatorname{ctg}(\pi+x)$

$\operatorname{ctg}x-\sqrt{2}\cos x=\frac{\cos x-\sqrt{2}\sin x\cos x}{\sin x}$, $\operatorname{tg}x\left(3-\sqrt{2}\sin x\right)=0$

$$\begin{cases}\operatorname{tg}x=0\\ \sin x=\frac{\sqrt{2}}{2}\end{cases}\Rightarrow\begin{cases}x=\pi k;\ k\in Z\\ x=(-1)^k\frac{\pi}{4}+\pi k;\ k\in Z\end{cases}$$

д) $2\sin x\cos x+4\cos x=3\sin x+2$

$(\cos x-1)(2\cos x(\sin x+2)-(3\sin x+2))=0$

$(2\cos x-1)(\sin x+2)=0$

$$\begin{cases}\cos x=\frac{1}{2}\\ \sin x=-2\end{cases}\Rightarrow\begin{cases}x=\pm\frac{\pi}{3}+2\pi k;\ k\in Z\\ x\in\varnothing\ (\sin x<-1)\end{cases}$$

~~б)~~ 335. ш) $\sin x+\cos x=0$ $\quad\cos x\neq 0$

$\operatorname{tg}x+1=0$

$\operatorname{tg}x=-1\Rightarrow x=-\frac{\pi}{4}+\pi k;\ k\in Z$

ф) $\sqrt{3}\cos x-\sin x=0$ $\quad\cos x\neq 0$

$\operatorname{tg}x-\sqrt{3}=0$

$\operatorname{tg}x=\sqrt{3}$

$x=\frac{\pi}{3}+\pi k;\ k\in Z$

г) $\cos x - 2\sin x = 0$ $\quad \cos x \neq 0$

$\operatorname{tg} x - 2 = 0$

$\operatorname{tg} x = 2$; $x = \operatorname{arctg} x + \pi k$; $k \in Z$

д) $4\cos x + \sin x = 0$

$\operatorname{tg} x = -4$

$x = -\operatorname{arctg} 4 + \pi k$; $k \in Z$

336. $\sin 8x + \sin 2x = 0$

$2\sin 5x \cos 3x = 0$

$\left[\begin{array}{l} \sin 5x = 0 \\ \cos 3x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{5} k \\ x = \frac{\pi}{6} + \frac{\pi}{3} k \end{array}\right.$

б) $\cos 5x + \cos 9x = 0$

$2\cos 7x \cos 2x = 0$

$\left[\begin{array}{l} \cos 7x = 0 \\ \cos 2x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{14} + \frac{\pi}{7} k; k \in Z \\ x = \frac{\pi}{4} + \frac{\pi}{2} k; k \in Z \end{array}\right.$

в) $\sin 7x = \sin(\pi - 3x)$

$\sin 7x - \sin 3x = 0$

$2\cos 5x \sin 2x = 0$

$\left[\begin{array}{l} \cos 5x = 0 \\ \sin 2x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{10} + \frac{\pi}{2} k; k \in Z \\ x = \frac{\pi}{2} k; k \in Z \end{array}\right.$

г) $\cos 6x = \sin\left(\frac{\pi}{2} + 4x\right)$.

$\cos 6x - \cos 4x = 0$

$2\sin 5x \sin x = 0$

$\left[\begin{array}{l} \sin 5x = 0 \\ \sin x = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{5} k, k \in Z \\ x = \pi k; k \in Z \end{array}\right.$

б) $\sin 9x - \cos x = 0$

$$\cos\left(\frac{\pi}{2} - 9x\right) - \cos x = 2\sin\left(\frac{\pi}{4} - 4x\right)\sin\left(\frac{\pi}{4} - 5x\right) =$$

$$= 2\sin\left(4x - \frac{\pi}{4}\right)\sin\left(5x - \frac{\pi}{4}\right)$$

$$\begin{cases} \sin\left(4x - \frac{\pi}{4}\right) = 0 \\ \sin\left(5x - \frac{\pi}{4}\right) = 0 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{16} + \frac{\pi}{4}k; \ k \in Z \\ x = \frac{\pi}{20} + \frac{\pi}{5}k; \ k \in Z \end{cases}$$

г) $\sin 2x + \cos 6x = 0$

$$\cos\left(\frac{\pi}{2} + 2x\right) + \cos 6x = 2\cos\left(\frac{\pi}{4} + 4x\right)\cos\left(\frac{\pi}{4} - 2x\right) =$$

$$= 2\cos\left(4x + \frac{\pi}{4}\right)\cos\left(2x - \frac{\pi}{4}\right)$$

$$\begin{cases} \cos\left(4x + \frac{\pi}{4}\right) = 0 \\ \cos\left(2x - \frac{\pi}{4}\right) = 0 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{16} + \frac{\pi}{4}k; \ k \in Z \\ x = \frac{3\pi}{8} + \frac{\pi}{2}k; \ k \in Z \end{cases}$$

337. $\cos x - \sqrt{3}\sin x = \sqrt{2}$

$$\frac{1}{2}\cos x - \frac{\sqrt{3}}{2}\sin x = \frac{\sqrt{2}}{2}$$

$$\cos\frac{\pi}{3}\cos x - \sin\frac{\sqrt{3}}{2}\sin x = \cos\left(x + \frac{\pi}{3}\right) = \frac{\sqrt{2}}{2}$$

$$x + \frac{\pi}{3} = \pm\frac{\pi}{4} + 2\pi k$$

$$x = \frac{\pi}{3} - \frac{\pi}{4} + 2\pi k = \frac{\pi}{12} + 2\pi k$$

$$x = \frac{\pi}{3} + \frac{\pi}{4} + 2\pi k = \frac{7\pi}{12} + 2\pi k$$

а) $\cos 2x + \sin 2x = 1$

$\cos\left(2x - \frac{\pi}{4}\right) = \frac{\sqrt{2}}{2}$

$2x - \frac{\pi}{4} = \pm\frac{\pi}{4} + 2\pi k$

$x = \pi k;\ k \in Z$

$x = \frac{\pi}{4} + \pi k;\ k \in Z$

б) $\cos x + \sin(-x) = -\sqrt{2}$

$\cos x - \sin x = -\sqrt{2}$

$\cos\left(x + \frac{\pi}{4}\right) = -1$

$x + \frac{\pi}{4} = \pi + 2\pi k$

$x = \frac{3\pi}{4} + 2\pi k;\ k \in Z$

в) $\sqrt{3}\cos x - 2\sin\frac{\pi}{6}\sin x = 2$

$\cos\frac{\pi}{6}\cos x - \sin\frac{\pi}{6}\sin x = 1$

$\cos\left(x + \frac{\pi}{6}\right) = 1$

$x + \frac{\pi}{6} = 2\pi k$

$x = -\frac{\pi}{6} + 2\pi k$

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ш) $\sin(\pi + 3x) + \cos(\pi - 3x) = \sqrt{1,5}$

$-(\sin 3x + \cos 3x) = \sqrt{\frac{3}{2}}$

$\cos\frac{\pi}{4}\cos 3x + \sin\frac{\pi}{4}\sin 3x = -\frac{\sqrt{3}}{2}$

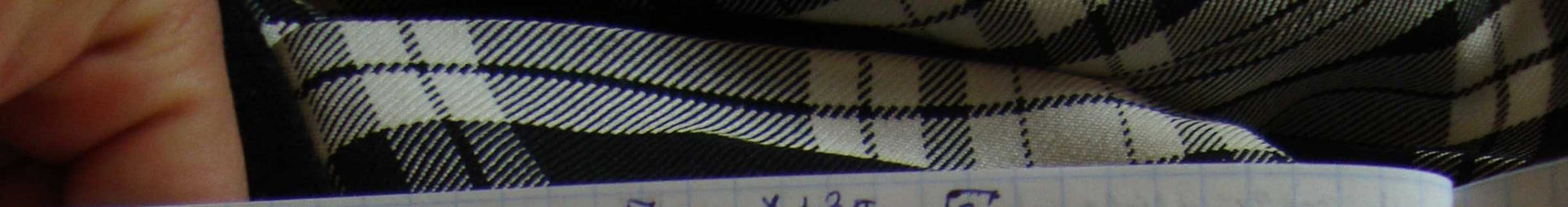
$\cos\left(3x - \frac{\pi}{4}\right) = -\frac{\sqrt{3}}{2}$

$3x - \frac{\pi}{4} = \pm\left(\pi - \frac{\pi}{6}\right) + 2\pi k$

$x = \frac{\pi}{12} \pm \frac{5\pi}{18} + \frac{2\pi k}{3}$

$x = \frac{3\pi - 10\pi}{36} + 2\pi k = -\frac{7\pi}{36} + \frac{2\pi k}{3}$

$x = \frac{3\pi + 10\pi}{36} + 2\pi k = \frac{13\pi}{36} + 2\pi k = \frac{\pi}{2} + \frac{2\pi k}{3}$



г) $\sin\frac{x-3\pi}{2} + \sqrt{3}\cos\frac{x+3\pi}{2} = \sqrt{3}$

$-\sin\left(\frac{3\pi}{2} - \frac{x}{2}\right) + \sqrt{3}\cos\left(\frac{3\pi}{2} + \frac{x}{2}\right) = \sqrt{3}$

$\sqrt{3}\sin\frac{x}{2} + \cos\frac{x}{2} = \sqrt{3}$

$\cos\frac{\pi}{3}\cos\frac{x}{2} + \sin\frac{\pi}{3}\sin\frac{x}{2} = \frac{\sqrt{3}}{2}$

$\cos\left(\frac{x}{2} - \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$

$\frac{x}{2} - \frac{\pi}{3} = \pm\frac{\pi}{6} + 2\pi k$

$\frac{x}{2} - \frac{\pi}{3} = -\frac{\pi}{6} + 2\pi k \Rightarrow x = \frac{\pi}{3} + 4\pi k$

$\frac{x}{2} - \frac{\pi}{3} = \frac{\pi}{6} + 2\pi k \Rightarrow x = \pi + 4\pi k$

д) $\cos 2x + \cos\left(\frac{\pi}{2} - 2x\right) = \sqrt{2}$

$\cos 2x + \sin 2x = \sqrt{2}$

$\cos\left(2x - \frac{\pi}{4}\right) = 1$

$2x - \frac{\pi}{4} = 2\pi k$

$x = \frac{\pi}{8} + \pi k;\ k \in Z$

Упр 339.

в) $\sqrt{3}\cos x + \sin x = 2\cos 3x$

$\cos\left(x - \frac{\pi}{6}\right) = \cos 3x$

$\cos\left(x - \frac{\pi}{6}\right) - \cos 3x = 0$

$2\sin\left(2x - \frac{\pi}{12}\right)\sin\left(-\left(x + \frac{\pi}{12}\right)\right) = 0$

$-2\sin\left(2x - \frac{\pi}{12}\right)\sin\left(x + \frac{\pi}{12}\right) = 0$

$\left[\begin{array}{l} \sin\left(2x - \frac{\pi}{12}\right) = 0 \\ \sin\left(x + \frac{\pi}{12}\right) = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} 2x - \frac{\pi}{12} = \pi k \\ x + \frac{\pi}{12} = \pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{24} + \frac{\pi}{2}k,\ k \in Z \\ x = -\frac{\pi}{12} + \pi k,\ k \in Z \end{array}\right.$

г) $\cos x + \sin x = \sqrt{2}\sin 3x$

$\cos\left(x - \frac{\pi}{4}\right) = \sin 3x$

$\cos\left(x - \frac{\pi}{4}\right) - \cos\left(\frac{\pi}{2} - 3x\right) = 0$

$2\sin\left(\frac{\pi}{8} - x\right)\sin\left(2x - \frac{3\pi}{8}\right) = 0$

$\left[\begin{array}{l} \sin\left(x - \frac{\pi}{4}\right) = 0 \\ \sin\left(2x - \frac{3\pi}{8}\right) = 0 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{8} + \pi k,\ k \in Z \\ x = \frac{3\pi}{16} + \frac{\pi}{2}k,\ k \in Z \end{array}\right.$

д) $\cos 7x - \sin 5x = \sqrt{3}(\cos 5x - \sin 7x)$

$\cos 7x + \sqrt{3}\sin 7x = \sqrt{3}\cos 5x + \sin 5x$

$\cos\left(7x - \frac{\pi}{3}\right) = \cos\left(5x - \frac{\pi}{6}\right)$

$\cos\left(7x - \frac{\pi}{3}\right) - \cos\left(5x - \frac{\pi}{6}\right) = 0$

$$2\sin\left(6x-\frac{\pi}{2}\right)\sin\left(x-\frac{\pi}{12}\right)=0$$

$$\left[\begin{array}{l}\sin\left(6x-\frac{\pi}{4}\right)=\pi k\\ \sin\left(x-\frac{\pi}{12}\right)=\pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x=\frac{\pi}{24}+\frac{\pi}{6}k;\ k\in Z\\ x=\frac{\pi}{12}+\pi k;\ k\in Z\end{array}\right.$$

2 вариант 340

а) $3\cos 5x+4\cos\left(\frac{\pi}{2}+5x\right)=5$

$3\cos 5x-4\cos 5x=5$

$\cos\left(\arccos\frac{3}{5}\right)\cos 5x-\sin\left(\arcsin\frac{4}{5}\right)\sin\left(\frac{\pi}{2}-5x\right)=1$

$\cos\left(5x+\arccos\frac{3}{5}\right)=1$

$5x+\arccos\frac{3}{5}=2\pi k$

$x=-\frac{1}{5}\arccos\frac{3}{5}+\frac{2}{5}\pi k$

б) $12\sin x+5\sin\left(\frac{3\pi}{2}+x\right)=6{,}5$

$12\sin x-5\cos x=\frac{13}{2}$

$\cos\left(\arccos\frac{5}{13}\right)\cos x-\sin\left(\arcsin\frac{12}{13}\right)\sin x=-\frac{1}{2}$

$\cos\left(x+\arccos\frac{5}{13}\right)=-\frac{1}{2}$

$x+\arccos\frac{5}{13}=\pm\left(\pi-\frac{\pi}{3}\right)+2\pi k$

$x=-\arccos\frac{5}{13}\mp\frac{2\pi}{3}+2\pi k$

$$2\sin\left(6x-\frac{\pi}{2}\right)\sin\left(x-\frac{\pi}{12}\right)=0$$

$$\left[\begin{array}{l}\sin\left(6x-\frac{\pi}{4}\right)=\pi k\\ \sin\left(x-\frac{\pi}{12}\right)=\pi k\end{array}\right. \Rightarrow \left[\begin{array}{l}x=\frac{\pi}{24}+\frac{\pi}{6}k;\ k\in Z\\ x=\frac{\pi}{12}+\pi k;\ k\in Z\end{array}\right.$$

Ответ 340

а) $3\cos 5x+4\cos\left(\frac{\pi}{2}+5x\right)=5$

$3\cos 5x-4\cos 5x=5$

$\cos\left(\arccos\frac{3}{5}\right)\cos 5x-\sin\left(\arcsin\frac{4}{5}\right)\sin\left(\frac{\pi}{2}-5x\right)=1$

$\cos\left(5x+\arccos\frac{3}{5}\right)=1$

$5x+\arccos\frac{3}{5}=2\pi k$

$x=-\frac{1}{5}\arccos\frac{3}{5}+\frac{2}{5}\pi k$

б) $12\sin x+5\sin\left(\frac{3\pi}{2}+x\right)=6{,}5$

$12\sin x-5\cos x=\frac{13}{2}$

$\cos\left(\arccos\frac{5}{13}\right)\cos x-\sin\left(\arcsin\frac{12}{13}\right)\sin x=-\frac{1}{2}$

$\cos\left(x+\arccos\frac{5}{13}\right)=-\frac{1}{2}$

$x+\arccos\frac{5}{13}=\pm\left(\pi-\frac{\pi}{3}\right)+2\pi k$

$x=-\arccos\frac{5}{13}\mp\frac{2\pi}{3}+2\pi k$

Задача 341

а) $2\sin^2 x + \sin x - 1 = 0$

$D = 1 + 8 = 9$

$\sin x_{1;2} = \dfrac{-1 \pm 3}{4}$ $\begin{matrix} -1 \\ \frac{1}{2} \end{matrix}$

$$\left[\begin{array}{l} \sin x = -1 \\ \sin x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = -\frac{\pi}{2} + 2\pi k \\ x = (-1)^k \frac{\pi}{6} + \pi k \end{array}\right.$$

б) $3\sin^2 x - 5\sin x - 2 = 0$

$D = 25 + 24 = 49$

$\sin x_{1;2} = \dfrac{5 \pm 7}{6}$ $\begin{matrix} -\frac{1}{3} \\ 2 \text{ не реш} \end{matrix}$

$\sin x = -\frac{1}{3}$

$x = (-1)^k \cdot (-1) \arcsin \frac{1}{3} + \pi k = (-1)^{k+1} \arcsin \frac{1}{3} + \pi k$

в) $6\cos^2 x + \cos x - 1 = 0$

$D = 1 + 24 = 25$

$\cos x_{1;2} = \dfrac{-1 \pm 5}{12}$ $\begin{matrix} -\frac{1}{2} \\ \frac{1}{3} \end{matrix}$

$$\left[\begin{array}{l} \cos x = -\frac{1}{2} \\ \cos x = \frac{1}{3} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k \\ x = \pm \arccos \frac{1}{3} + 2\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pm \frac{2\pi}{3} + 2\pi k \\ x = \pm \arccos \frac{1}{3} + 2\pi k \end{array}\right.$$

Задача 341

а) $2\sin^2 x + \sin x - 1 = 0$

$D = 1 + 8 = 9$

$\sin x_{1;2} = \frac{-1 \pm 3}{4}$ ⟨ -1; $\frac{1}{2}$

$$\left[\begin{array}{l} \sin x = -1 \\ \sin x = \frac{1}{2} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = -\frac{\pi}{2} + 2\pi k \\ x = (-1)^k \frac{\pi}{6} + \pi k \end{array}\right.$$

в) $3\sin^2 x - 5\sin x - 2 = 0$

$D = 25 + 24 = 49$

$\sin x_{1;2} = \frac{5 \pm 7}{6}$ ⟨ $-\frac{1}{3}$; 2 ch рим

$\sin x = -\frac{1}{3}$

$x = (-1)^k \cdot (-1) \arcsin\frac{1}{3} + \pi k = (-1)^{k+1} \arcsin\frac{1}{3} + \pi k$

д) $6\cos^2 x + \cos x - 1 = 0$

$D = 1 + 24 = 25$

$\cos x_{1;2} = \frac{-1 \pm 5}{12}$ ⟨ $-\frac{1}{2}$; $\frac{1}{3}$

$$\left[\begin{array}{l} \cos x = -\frac{1}{2} \\ \cos x = \frac{1}{3} \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k \\ x = \pm \arccos\frac{1}{3} + 2\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pm\frac{2\pi}{3} + 2\pi k \\ x = \pm \arccos\frac{1}{3} + 2\pi k \end{array}\right.$$

г) $4\cos^2 x - 8\cos x + 3 = 0$

$D = 64 - 48 = 16$

$\sqrt{D} = 16 - 12 = 4$

$\cos x_{1;2} =$

$\cos x_{1;2} = \frac{4 \pm 2}{4} \begin{cases} \frac{1}{2} \\ \frac{3}{2} \text{ ch rozw} \end{cases}$

$x = \pm \frac{\pi}{3} + 2\pi k$

z/wyd 342

ш) $3tg^2 x + 2tgx - 1 = 0$

$D = 4 + 3 = 4$

$tgx_{1;2} = \frac{-1 \pm 2}{3} \begin{cases} -1 \\ \frac{1}{3} \end{cases}$

$x = -\frac{\pi}{4} + \pi k$

$x = arctg\frac{1}{3} + \pi k$

343 a) $\cos 2x + 3\sin x - 2 = 0$

$1 - 2\sin^2 x + 3\sin x - 2 = 0$

$2\sin^2 x - 3\sin x + 1 = 0$

$D = 9 - 8 = 1$

$\sin x_{1;2} = \frac{3 \pm 1}{4} \begin{cases} \frac{1}{2} \\ 1 \end{cases}$

$\begin{cases} x = (-1)^k \frac{\pi}{6} + \pi k \\ x = \frac{\pi}{2} + 2\pi k \end{cases}$

(x) $\cos 2x$)

р) $2tg^2x + 3tgx - 2 = 0$

$b = 9 + 16 = 25$

$tgx_{1;2} = \frac{-3 \pm 5}{4} \begin{matrix} -2 \\ \frac{1}{2} \end{matrix}$

$\begin{cases} x = -arctg2 + \pi k \\ x = arctg\frac{1}{2} + \pi k \end{cases}$

с) $tgx - 2ctgx + 1 = 0$

$tgx \neq 0$

$tg^2x + tgx - 2 = 0$

$b = 1 + 8 = 9$

$tgx_{1;2} = \frac{-1 \pm 3}{2} \begin{matrix} -2 \\ 1 \end{matrix}$

$\begin{cases} x = -arctg2 + \pi k \\ x = \frac{\pi}{4} + \pi k \end{cases}$

т) $2ctgx - 3tgx + 5 = 0$

$ctgx \neq 0$

$2ctg^2x + 5ctgx - 3 = 0$

$b = 25 + 24 = 49$

$ctgx_{1;2} = \frac{-5 \pm 7}{4} \begin{matrix} -3 \\ \frac{1}{2} \end{matrix}$

$\begin{cases} x = \pi - arcctg3 + \pi k \\ x = arcctg\frac{1}{2} + \pi k \end{cases}$

ш) $2\cos^2x + 5\sin x - 4 = 0$

$1 + \cos 2x + 5\sin x - 4 = 0$

$2 - 2\sin^2x + 5\sin x - 4 = 0$

$2\sin^2x - 5\sin x + 2 = 0$

$b = 25 - 16 = 3^2$

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$2(1 - \sin^2x) + 5\sin x - 4 = 0$

$2\sin^2x - 5\sin x + 2 = 0$

$\sin x_{1;2} = \frac{+5 \pm 3}{4} \begin{matrix} \frac{1}{2} \\ 2 \text{ т.к. } \varnothing \end{matrix}$

$X = (-1)^k \frac{\pi}{6} + \pi k;\ k \in Z$

г) $\cos 2x - 5\sin x - 3 = 0$

$1 - 2\sin^2 x - 5\sin x - 3 = 0$

$2\sin^2 x + 5\sin x + 2 = 0$

$D = 25 - 16 = 9$

$\sin x_{1;2} = \frac{-5 \pm 3}{4} \begin{cases} -\cancel{\frac{8}{4}} = -2 \text{ не уд.} \\ -\frac{1}{2} \end{cases}$

$\begin{cases} X = -\frac{\pi}{6} + \pi k;\ k \in Z. \end{cases}$

д) $-2 + 3\cos x = \cos 2x$

$-2 + 3\cos x - 2\cos^2 x + 1 = 0$

$2\cos^2 x - 3\cos x + 1 = 0$

$D = 9 - 8 = 1$

$\cos x_{1;2} = \frac{3 \pm 1}{4} \begin{cases} \frac{1}{2} \\ 1 \end{cases}$

$\begin{cases} \cos x = \frac{1}{2} \\ \cos x = 1 \end{cases} \Rightarrow \begin{cases} X = \pm \frac{\pi}{3} + 2\pi k \\ X = 2\pi k \end{cases}$

№ 344

е) $\cos^4 x + \sin^4 x = 1$

$(\cos^2 x + \sin^2 x)^2 - 2\sin^2 x \cos^2 x - 1 = 0$

$-\cancel{2\sin} - \sin^2 2x = 0$

$\sin 2x = 0$

$2x = \pi k \Rightarrow x = \frac{\pi}{2} k;\ k \in Z.$

а) $7\cos^4 2x + \sin^4 2x = 1$

$(\sqrt{7}\cos^2 2x + \sin^2 2x)^2 - 2\sqrt{7}\cos^2 2x \sin^2 2x - 1 = 0$

$(7\cos^4 2x + \sin^4 2x = (\sin^2 2x + \cos^2 2x)^2$

$7\cos^4 2x + \sin^4 2x = \sin^4 2x + 2\cos^2 2x \sin^2 2x + \cos^4 2x$

$6\cos^4 2x - 2\cos^2 2x \sin^2 2x = 0$

$2\cos^2 2x(3\cos^2 2x - \sin^2 2x) = 0)$

$6\cos^4 2x + (\sin^2 2x + \cos^2 2x)^2 - 2\sin^2 2x \cos^2 2x = 1$

$6\cos^4 2x - 2\sin^2 2x \cos^2 2x = 0$

$\cos^2 2x(6\cos^2 2x - 2\sin^2 2x) = 0$

$\cos^2 2x(3(1+\cos 4x) - (1-\cos 4x)) = 0.$

$\cos^2 2x(2 + 2\cos 4x) = 0$

$2\cos^2 2x(1 + \cos 4x) = 0$

$$\begin{cases} \cos 2x = 0 \\ \cos 4x = -1 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{4} + \frac{\pi}{2}k \\ x = \frac{\pi}{4} + \frac{1}{2}\pi k \end{cases}$$

г) $4\sin^4 x - 1 = 5\cos^2 x$

$(2\sin^2 x - 1)(2\sin^2 x + 1) = 5\cos^2 x$

$-\cos 2x(2 - \cos 2x) = 5\frac{(1+\cos 2x)}{2}$

$2\cos^2 2x - 4\cos 2x - 5 - 5\cos 2x = 0$

$2\cos^2 2x - 9\cos 2x - 5 = 0$

$D = 81 + 40 = 121 = 11^2$

$$\cos 2x_{1;2} = \frac{9 \pm 11}{4} \begin{matrix} \nearrow -\frac{1}{2} \\ \searrow 5 \text{ не уд.} \end{matrix}$$

$$\cos 2x = -\frac{1}{2}$$

$$x = \pm\left(\frac{\pi}{2} - \frac{\pi}{6}\right) + 2\pi k = \pm\frac{\pi}{3} + 2\pi k$$

7) $\sin^4\frac{x}{4} - \cos^4\frac{x}{4} = \frac{1}{2}$

$$\left(\sin^2\frac{x}{4} - \cos^2\frac{x}{4}\right)\left(\sin^2\frac{x}{4} + \cos^2\frac{x}{4}\right) = \frac{1}{2}$$

$$-\cos\frac{x}{2} = \frac{1}{2}$$

$$\frac{x}{2} = \pm\left(\pi - \frac{\pi}{3}\right) + 2\pi k$$

$$x = \pm\frac{4\pi}{3} + 4\pi k$$

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$\sin^4 x + \cos^3 x = 1$

$\sin^4 x + \cos^3 x - (\sin^2 x + \cos^2 x)^2 = 0$

$\cos^3 x - \cos^4 x - 2\sin^2 x\cos^2 x = 0$

$\cos^4 x - \cos^3 x + 2\sin^2 x\cdot\cos^2 x = 0$

$\cos^2 x(\cos^2 x - \cos x + 2(1 - \cos^2 x)) = 0$

$\cos^2 x(\cos^2 x + \cos x - 2) = 0$

$$\begin{bmatrix} \cos^2 x = 0 \\ \cos^2 x + \cos x - 2 = 0 \end{bmatrix} \Rightarrow \begin{bmatrix} x = \frac{\pi}{2} + \pi k \\ D = 1 + 8 = 9 \end{bmatrix}$$

$\cos x_{1,2} = \frac{-1 \pm 3}{2}$ $\begin{cases} -2 \text{ zh qabul} \\ 1 \end{cases}$

$\left[\begin{array}{l} x = \frac{\pi}{2} + \pi k \\ \cos x = -2 \Rightarrow x \in \varnothing \\ \cos x = 1 \Rightarrow x = 2\pi k \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k \\ x = 2\pi k \end{array}\right.$

b) $\cos^4 x - \cos^3 x = 1$?

(3/und 344.

3/und 345

w) $\sin^4 x + \cos^3 x = 1$

$\cos^3 x = (1 - \sin^2 x)(1 + \sin^2 x)$

$\cos^3 x = \cos^2 x (1 + \sin^2 x)$

$\cos^2 x (\cos x - 1 - \sin^2 x) = 0$

$\cos^2 x (\cos x - 1 - 1 + \cos^2 x) = 0$

$\cos^2 x (\cos^2 x + \cos x - 2) = 0$

$\left[\begin{array}{l} \cos x = 0 \\ \cos^2 x + \cos x - 2 = 0 \end{array}\right. \Rightarrow$

$D = 1 + 8 = 9$

$\cos x = \frac{-1 \pm 3}{2}$ $\begin{cases} -2 \text{ zh qabul} \\ 1 \end{cases}$

$\left[\begin{array}{l} \cos x = 0 \\ \cos x = 1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \frac{\pi}{2} + \pi k \\ x = 2\pi k \end{array}\right.$

е) $\cos^4 x - \sin^3 x = 1$

$\sin^3 x = -(1-\cos^2 x)(1+\cos^2 x)$

$\sin^3 x = -\sin^2 x(1+\cos^2 x)$

$\sin^2 x(\sin x + 1 + \cos^2 x) = 0$

$\sin^2 x(\sin x + 1 + 1 - \sin^2 x) = 0$

$-\sin^2 x(\sin^2 x - \sin x - 2) = 0$

$\left[\begin{array}{l} \sin x = 0 \\ \sin^2 x - \sin x - 2 = 0 \end{array}\right.$

$D = 1 + 8 = 9$

$\sin x_{1;2} = \frac{1 \pm 3}{2} \swarrow^{-1}_{2}$

$\left[\begin{array}{l} \sin x = 0 \\ \sin x = -1 \end{array}\right. \Rightarrow \left[\begin{array}{l} x = \pi k \\ x = -\frac{\pi}{2} + 2\pi k \end{array}\right.$

ж). $\sin^3 x \cos 3x + \cos^3 x \sin 3x = \frac{3}{8}$

$\sin^2 x \cdot \sin x \cos 3x + \cos^2 x \cdot \cos x \sin 3x = \frac{3}{8}$

$\frac{1}{2}\sin^2 x(\sin 4x + \sin 2x) + \frac{1}{2}\cos^2 x(\sin 4x + \sin 2x) = \frac{3}{8}$ $\quad |\cdot 2$

$(1-\cos 2x)(\sin 4x - \sin 2x) + (1+\cos 2x)(\sin 4x + \sin 2x) - \frac{3}{4} = 0$

$\sin 4x - \sin 2x - \cos 2x \sin 4x + \cos 2x \sin 2x + \sin 4x + \sin 2x +$

$+ \cos 2x \sin 4x + \cos 2x \sin 2x - \frac{3}{4} = 0$

$2\sin^2 x + 2\cos 2x \sin 2x - \frac{3}{4} = 0$

$\sin 4x + \cos 2x \sin 2x - \frac{3}{2} = 0$

$3\sin 2x \cos 2x - \frac{3}{2} = 0$

$\sin 2x \cos 2x - \frac{1}{2} = 0$

$\frac{1}{2}\sin 2x - \frac{1}{2} = 0$

$\sin 2x - 1 = 0$

$2\sin 2x \cos 2x - \sin^2 x - \cos^2 x = 0$

$\sin^2 x - 2\sin 2x \cos 2x - \cos^2 x = 0$

$tg^2 x - 2tgx - 1 = 0$

$D = 4 - 4 = 0$

$tgx = \frac{2}{2} = 1$

$x = \frac{\pi}{4} + \pi k$

№ 346

$3\sin^2 x - \sin x \cos x = 2\cos^2 x$

$3\sin^2 x - \sin x \cos x - 2\cos^2 x = 0 \qquad \cos x \neq 0.$

$3tg^2 x - tgx - 2 = 0$

$D = 1 + 24 = 25$

$tgx_{1;2} = \frac{1 \pm 5}{6}$ → $\frac{2}{3}$, 1

$\left[\begin{array}{l} x = arctg\frac{2}{3} + \pi k \\ x = \frac{\pi}{4} + \pi k \end{array}\right.$

е) $2\cos^2 x - 3\sin x\cos x + \sin^2 x = 0$ $\quad \cos x \neq 0$

$2\sin^2 x - 3\sin x\cos x + 2\cos^2 x = 0$

$tg^2 x - 3tgx + 2 = 0$

$D = 9 - 8 = 1$

$tgx_{1;2} = \frac{3 \pm 1}{2} \begin{matrix} \nearrow 1 \\ \searrow 2 \end{matrix}$

$$\left[\begin{array}{l} x = \frac{\pi}{4} + \pi k \\ x = arctg2 + \pi k \end{array}\right.$$

ж) $9\sin x\cos x - 7\cos^2 x = 2\sin^2 x$ $\quad \cos x \neq 0$

$2\sin^2 x - 9\sin x\cos x + 7\cos^2 x = 0$

$2tg^2 x - 9tgx + 7 = 0$

$D = 81 - 56 = 25$

$tgx_{1;2} = \frac{9 \pm 5}{4} \begin{matrix} \nearrow 1 \\ \searrow 3{,}5 \end{matrix}$

$$\left[\begin{array}{l} x = \frac{\pi}{4} + \pi k \\ x = arctg\,3{,}5 + \pi k \end{array}\right.$$

з) $2\sin^2 x - \sin x\cos x - \cos^2 x = 0$ $\quad \cos x \neq 0$

$2tg^2 x - tgx - 1 = 0$

$D = 1 + 8 = 9$

$tgx_{1;2} = \frac{1 \pm 3}{4} \begin{matrix} \nearrow -\frac{1}{2} \\ \searrow 1 \end{matrix} \Rightarrow \left[\begin{array}{l} x = -arctg0{,}5 + \pi k \\ x = \frac{\pi}{4} + \pi k \end{array}\right.$

2) Задача 347.

а) $2\sin 2x = 6\cos^2 x - 1$

$\sin^2 x + 4\sin x\cos x - 5\cos^2 x = 0 \quad \cos x \neq 0$

$tg^2 x + 4tgx - 5 = 0$

$(D = 16 + 20 = 36) \quad \frac{D}{4} = 4 + 5 = 9$

$(tgx_{1;2} =)$ $\quad tgx_{1;2} = \frac{-2 \pm 3}{1} \begin{matrix} -5 \\ 1 \end{matrix}$

$$\begin{cases} x = arctg5 + \pi k \\ x = \frac{\pi}{4} + \pi k \end{cases}$$

д) $2\sin^2 x - \cos 2x + \sin 2x = 0$

$(2\sin^2 x - 2\cos^2 x + 1)$

$2\sin^2 x - \cos^2 x + \sin^2 x - \cos 2x + \sin 2x = 0$

$\sin 2x - 2\cos 2x + 1 = 0$

$\sin 2x - 2\cos 2x = -1$

$2\cos 2x - \sin 2x = 1$

$\cos\left(\arccos\frac{2}{\sqrt{5}}\right)\cos 2x - \sin\left(\arcsin\frac{1}{\sqrt{5}}\right)\sin 2x = \frac{1}{\sqrt{5}}$

$\cos\left(arctg\frac{1}{2} + 2x\right) = \frac{1}{\sqrt{5}}$

$arctg\frac{1}{2} + 2x = \pm\arccos\frac{1}{\sqrt{5}} + 2\pi k, \ldots$

$x = \frac{1}{2}\arccos\frac{2}{\sqrt{5}} \pm \left(\frac{\pi}{2} - \arccos\frac{2}{\sqrt{5}}\right) + 2\pi k$

$$x = \frac{1}{2}\arccos\frac{2}{\sqrt{5}} - \left(\frac{\pi}{2} - \arccos\frac{2}{\sqrt{5}}\right) + 2\pi k =$$

$$= \frac{3}{2}\operatorname{arctg}\frac{1}{2} - \frac{\pi}{2} + 2\pi k$$

$$x = \frac{1}{2}\arccos\frac{2}{\sqrt{5}} + \frac{\pi}{2} - \arccos\frac{2}{\sqrt{5}} + 2\pi k =$$

$$= -\frac{1}{2}\operatorname{arctg}\frac{1}{2} + \frac{\pi}{2} + 2\pi k$$

ч) $5\sin x\cos x + 1 = 7\cos^2 x$

$$2\sin^2 x + 5\sin x\cos x - 6\cos^2 x = 0$$

$$tg^2 x + 5tgx - 6 = 0$$

$$D = 25 + 24 = 49$$

$$tgx_{1;2} = \frac{-5 \pm 7}{2} \begin{cases} -6 \\ 1 \end{cases}$$

$$\begin{cases} x = -\operatorname{arctg} 6 + \pi k \\ x = \frac{\pi}{4} + \pi k \end{cases}$$

ш) $1 + 3\cos^2 x = 5\sin x\cos x$

$$\sin^2 x - 5\sin x\cos x + 4\cos^2 x = 0 \qquad \cos x \neq 0;$$

$$tg^2 x - 5tgx + 4 = 0$$

$$D = 25 - 16 = 9$$

$$tgx_{1;2} = \frac{5 \pm 3}{2} \begin{cases} 1 \\ 4 \end{cases}$$

$$\begin{cases} x = \frac{\pi}{4} + \pi k \\ x = \operatorname{arctg} 4 + \pi k \end{cases}$$

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ш) $\cos 7x \cos 13x = \cos x \cos 19x$

$\frac{1}{2}(\cos 20x + \cos 6x) = \frac{1}{2}(\cos 20x + \cos 18x)$

$\cos 18x - \cos 6x = 0$

$2 \sin 12x \sin 6x = 0$

$\sin 12x = 2 \sin x \cos x \Rightarrow$

$\Rightarrow \sin 12x = 0.$

$X = \frac{\pi}{12} k$

р) $\sin x \sin 6x = \sin 8x \sin 3x$

$\frac{1}{2}(\cos 5x - \cos 7x) = \frac{1}{2}(\cos 5x - \cos 12x)$

$\cos 12x - \cos 7x = 0$

$2 \sin 9{,}5x \sin 2{,}5x = 0$

$\left[\begin{array}{l} x = \frac{2}{19}\pi k \; ; \; k \in Z \\ x = \frac{2}{5}\pi k \; ; \; k \in Z \end{array}\right.$

с) $\sin 5x \cos 3x = \sin 9x \cos 7x$

$\frac{1}{2}(\sin 8x - \sin 2x) = \frac{1}{2}(\sin 16x - \sin 2x)$

$\sin 16x - \sin 8x = 0$

$2 \cos 12x \sin 4x = 0$

$\left[\begin{array}{l} x = \frac{\pi}{24} + \frac{\pi}{12} k \\ x = \frac{\pi}{4} k \end{array}\right.$

а) $\sin x \cos 5x = \sin 2x \cos 4x$

$$\frac{1}{2}(\sin 6x + \sin 4x) = \frac{1}{2}(\sin 6x - \sin 2x)$$

$$\sin 4x - \sin 2x = 0$$

$$\sin 2x (2\cos x - 1) = 0$$

$$\begin{cases} \sin 2x = 0 \\ \cos x = \frac{1}{2} \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{2} k \\ x = \pm \frac{\pi}{3} + 2\pi k \end{cases}$$

$$2\cos 3x \sin x = 0$$

$$\begin{cases} x = \frac{\pi}{6} + \frac{\pi}{3} k \\ x = \pi k \end{cases}$$

Учеб. 349.

ж) $\cos 4x + \cos 2x = \cos 9x + \cos 3x$

$$2\cos 3x \cos x = 2\cos 6x \cos 3x$$

$$2\cos 3x (\cos x - \cos 6x) = 0$$

$$2\cos 3x \left(-2\sin \frac{7}{2}x \sin \frac{5}{2}x\right) = 0$$

$$\begin{cases} \cos 3x = 0 \\ \sin \frac{7}{2}x = 0 \\ \sin \frac{5}{2}x = 0 \end{cases} \Rightarrow \begin{cases} x = \frac{\pi}{6} + \frac{\pi}{3} k \\ x = \frac{2}{7}\pi k \\ x = \frac{2}{5}\pi k \end{cases}$$

е) $\sin x+\sin 2x+\sin 3x+\sin 4x=0$

$2\sin 2x\cos x+2\sin 3x\cos x=0$

$2\cos x(\sin 2x+\sin 3x)=0$

$2\cos x\cdot 2\sin\frac{5}{2}x\cos\frac{1}{2}x=0$

$\left[\begin{array}{l}\cos x=0\end{array}\right.$

ж) $\sin 8x-\sin 6x+\sin 4x-\sin 2x=0$

$2\cos 7x\sin x+2\cos 3x\sin x=0$

$2\sin x(\cancel{+}2\cos 5x\cos 2x=0\ \ldots$

2 умр 350

ш) $\sin^2 x+\sin^2 2x+\sin^2 3x=1{,}5$

$\frac{1-\cos 2x}{+\,+\,+}+1+\cos 4x+1-\cos 6x=3$

$\cos 2x+\cos 4x+\cos 6x=0$

$2\cos 4x\cos 2x+\cos 4x=0$

$\cos 4x(2\cos 2x+1)=0.$

р) $\cos^2 x+\cos^2 2x-\sin^2 3x=0{,}5$

$1+\cos 2x+1+\cos 4x-1+\cos 6x=1$

$\cos 2x+\cos 4x+\cos 6x=0$

$\sin x+\frac{1}{2}\sin 3x=0$

$(\sin x+\sin 3x)+\sin x=0$

$2\sin 2x\cos x+\sin x=0$

$2\sin x\cos^2 x+\sin x=0$

$\sin x(2\cos^2 x+1)=0$

$\left[\begin{array}{l}\sin x=0\\ \cos x=\frac{\sqrt{2}}{2}\end{array}\right.$

с) $\sin^2\left(\frac{\pi}{4}+\frac{x}{2}\right)-\sin^2\left(\frac{3\pi}{4}+\frac{x}{2}\right)=\sin\frac{7\pi}{6}\sin 3x$

$\left(\sin\left(\frac{\pi}{4}+\frac{x}{2}\right)-\sin\left(\frac{3\pi}{4}+\frac{x}{2}\right)\right)\left(\sin\left(\frac{\pi}{4}+\frac{x}{2}\right)+\sin\left(\frac{3\pi}{4}+\frac{x}{2}\right)\right)=-\sin\frac{\pi}{6}\sin 3x$

$\left(2\cos\left(\frac{\pi}{2}+\frac{x}{2}\right)\sin\left(-\frac{\pi}{4}\right)\cdot 2\sin\left(\frac{\pi}{2}+\frac{x}{2}\right)\cos\left(-\frac{\pi}{4}\right)=-\sin\frac{\pi}{6}\sin 3x\right.$

$4\left(-\sin\frac{x}{2}\right)\left(-\sin\frac{\pi}{4}\right)\cdot\cos\frac{x}{2}\cos\frac{\pi}{4}=2^1\sin x\cdot\frac{2}{4_2}\,1=-\sin\frac{\pi}{6}\sin 3x$

Animals

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